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MAORI FORTIFICATIONS OF THE TATARAIMAKA DISTRICT, TARANAKI

NIGEL PRICKETT

AUCKLAND INSTITUTE AND MUSEUM

Abstract. Thirty-two Maori fortifications are described from the Tataraimaka district, Taranaki, North Island, New Zealand. The majority of sites have ring-ditch defences. Much of the survey area may be characterised as having an unusually high concentration of pa, many of which are of closely similar form.

This paper continues the description of pre-European Maori fortifications of the region between New Plymouth and Stoney River, in Taranaki, North Island,New Zealand. A background to the programme and the reasons for undertaking the research have already been published along with the results of the first years' field work in the Omata and Oakura districts (Prickett 1980). The programme will conclude at Stoney River with one more summer's work. The present work covers a somewhat wider area than the historical Tataraimaka Block, which lay between the Timaru and Katikara Rivers. To the north-east I have included pa on the right bank of Timaru River, and Patuha (N108/157) and N108/180 in the Kaitake Range. To the south-west the survey area extends to the right bank of Katikara River.

A general description of the programme area has already been given (Prickett 1980). Topographically, the Tataraimaka district consists of extensive terraces deeply cut by the broad valleys of the Katikara and Timaru Rivers, and sharply incised by other, smaller streams. On the coast is a wide inter-tidal platform of rocky reefs which is sometimes backed by a sandy beach. A low sea cliff rises directly to terrace country which allows easy access to the foot of the precipitous Kaitake Range more than 4 km inland. The Timaru and Katikara Rivers do not rise in the Kaitake Range but skirt its southern margin and rise ultimately in the higher Pouakai Range inland. Maori fortifications in the Tataraimaka district are, except Patuha and N108/180, located on the narrow coastal plain, and are never more than 4.5 km from the sea. The district, like the entire survey area, falls within the traditional territory of the Nga Mahanga section of the Taranaki tribe.

This paper reports the results of four weeks mapping of sites of the Tataraimaka district by one field team in November and December 1980. Most sites were mapped by alidade and plane table, while a few, where topography and vegetation cover required, were surveyed by tape and compass and 'dumpy' level. A further two weeks in the field in April and May 1981 allowed checking of plans and the location and recording of some further sites which are now too badly damaged for useful mapping.

The survey area falls within the NZMS1 series map N108 (New Plymouth). Map references are from the third edition, 1970. Site numbers refer to the New Zealand Archaeological Association site recording scheme. Names ascribed to pa were obtained from the original Lands and Survey Department blocksheets covering the Wairau and

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Cape Survey Districts, which are now held in the Lands and Survey Department, New Plymouth. The 1950 aerial photographs referred to are from the New Zealand Aerial Mapping Ltd (Hastings) series, which are held by the Lands and Survey Department.

The distribution of pa within the surveyed area is shown in Figure 1. Presentation of individual sites is organised geographically by stream or river catchment areas, working in general from east to west through the surveyed region.

N108/180 (533813)

On the Lands and Survey Department Blocksheet Cape III (14/5A) two Maori fortifications are shown on the left bank of Waimoku Stream at the Egmont National Park boundary. Just outside the park boundary, within the sharp left bend of the stream, is a work depicted in stylised form as a ring-ditch pa, which is given the name 'Waimoku' (map reference 534817). No trace of this site has survived. The area was cleared of light bush about 1960, and the destruction of whatever was there presumably dates to that time.

Up the same spur, just within the national park boundary, the Blocksheet shows another, larger, work. This pa has survived, although considerably damaged during the removal of pine trees from this part of the park, again about 1960. The site is located *ca.* 200 m above sea level, on the prominent forward knoll of a ridge which descends from the Kaitake Ranges. It commands an extensive view to the north and west. To the east is the deep cut gully of Waimoku Stream, while westwards is a precipitous slope down to the rising ground about the main road. At the north end the spur rises easily from the site of the now vanished Waimoku pa. At the south end is a broad saddle, very little below the occupation platform of the fortification. The site is now covered by mamaku, mahoe and other native species, with a tangle of felled pines in places.

Artificial works comprise a bank which encircles the site, supplemented by a ditch for most of the circumference. At the north end the scarp rises 3.5 m high from a 6 m wide terrace. Elsewhere it is lower, although the extent to which the ditch has been filled makes accurate assessment difficult. At the south end of the site is an especially well formed ditch and bank defending the most vulnerable approach. Log-hauling tracks cut through the defences in many places. The defended area is *ca.* 120 m long, with an area in excess of 2500 m^2. The south end of the occupation area is *ca.* 30 m wide. Approximately halfway down the site to the north the platform dips away and narrows to as little as 15 m. Close to the transverse defence at the south end are indications of perhaps three or four *rua*.

Patuha N108/157 (547788)

Patuha is situated on the Kaitake Range at *ca.* 600 m above sea level, on a steep ridge which falls to the south-west from Patuha peak (and trig station). The knob which is occupied by the pa is a prominent one and is easily visible from farm country and the main road in the Tataraimaka area. The site is now under bush with some higher rocky ground under grass. Although tree roots have undoubtedly broken up sub-surface deposits, the site is probably in fair condition since it has not suffered from farming activity and the rocky spine of the ridge has prevented natural erosion.

The fortification is protected by its remote and commanding location within an extensive area of broken bush country. Access down the ridge is barred by a low saddle

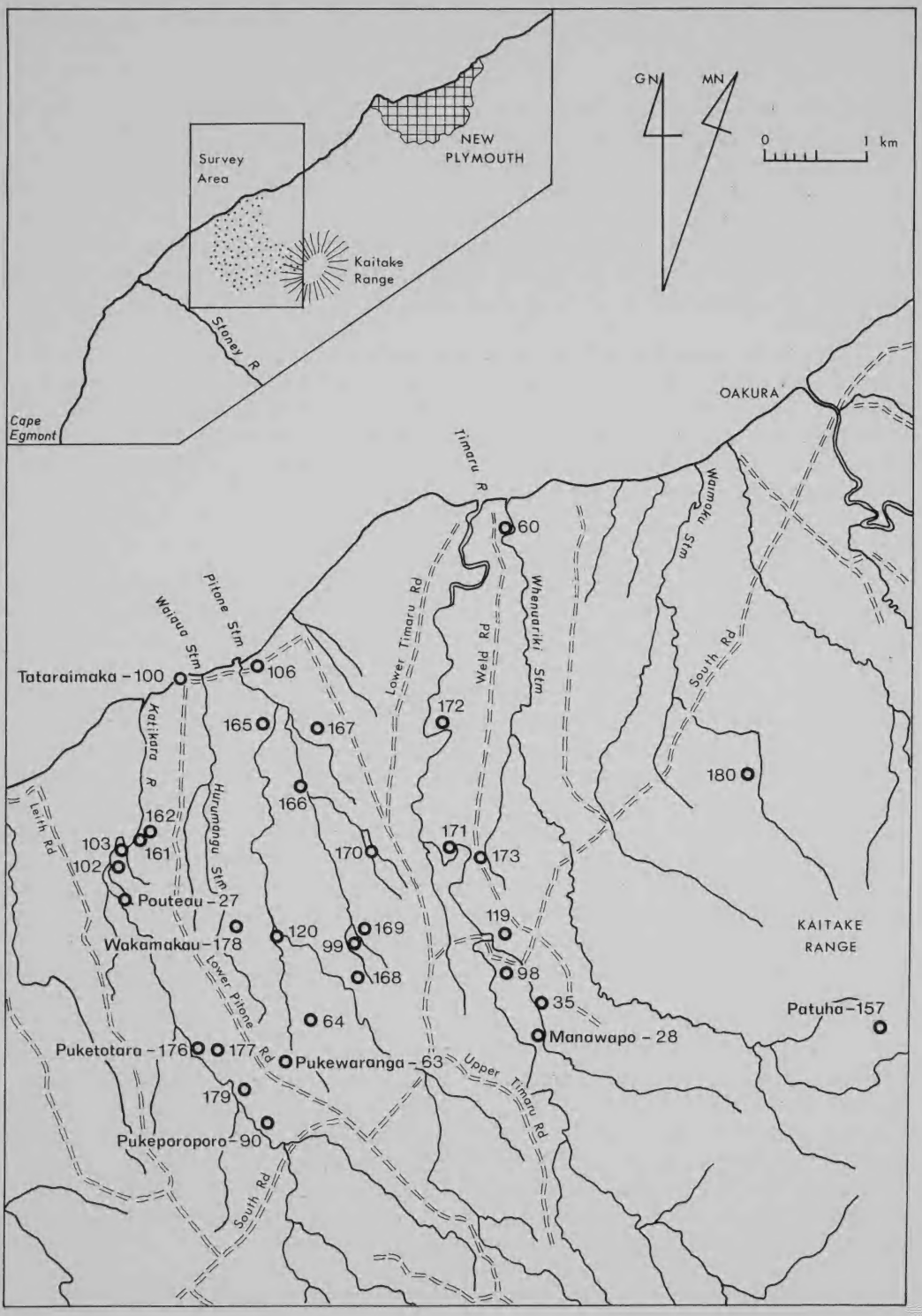


Fig. 1. Distribution of pa in the Tataraimaka district, Taranaki.

Steep scarp	Slope change	Base of cliff
Moderate scarp	Rua	A—— Section
Small scarp	Depression	Fenceline
Stone-faced scarp		

Key for Figs. 2, 6, 8, 10, 12, 16, 19, 21-28, 33, 35, 36.

leading to a precipitous 30 m face which rises directly to the occupation area. Access up the ridge is increasingly steep and narrow as the pa is approached. The two flanks of the site fall steeply 150-200 m into adjacent valleys, with a 100 m cliff near the western end making the pa virtually impregnable at this point. Despite the precipitous flanks of the site, however, it would be difficult to guard all points against an approach through the bush to close beneath the defended area. Artificial defence may be present in the form of a cutting away of the toe of the face which drops to the saddle up the ridge. The naturally rocky and precipitous spur rules out identification of other defensive modifications.

The total occupation area is *ca.* 100 m long and varies between 10 and 20 m width. It consists of two high points and a connecting saddle some 8-10 m lower. The upper high point is the larger and includes a side spur which extends 30-40 m to the north. There are several prepared platforms and terraces on this high point which may have an area of between 600 and 800 m^2. Two *rua* were found on the site including one in the intervening saddle and one on the major high point.

Manawapo N108/28 (513787) Figs. 2, 3, 4

Manawapo is situated on a long ridge which extends north-west from the southern margin of the Kaitake Range between Timaru River and Te Komete Stream. Nearby fortifications are N108/98, at the end of the ridge 700 m north-west of Manawapo, and N108/35 across the gully to the north. The upper occupation platforms of the pa stand 40-50 m above the river to the west and perhaps 20 m above the narrow gully of Te Komete Stream to the east. The name is given by W.H. Skinner in his *Reminiscences of a Taranaki Surveyor* (1946:64) where the pa is numbered among the major fortifications of the Tataraimaka district along with Pukeporoporo (N108/90), on the right bank of Katikara River, and Tataraimaka itself (N108/100). Manawapo is now under pasture, with scattered trees including karaka, rewarewa, totara and cabbage trees on the site and remnant patches of bush outside the defences to the north-west and in the nearby river valley. Most of the scarps, ditches and platforms are in good or excellent order; at some time in the past, however, there has been considerable bulldozer preparation of farm tracks along the east and south-west margins of the site, through the defences of the north end, and cutting banks and scarps in many places to give wheeled access to all the major occupation platforms.

Topography gives Manawapo excellent natural defence. From its elevated situation it commands a useful view across neighbouring valleys and over spurs and terraces beyond. The two flanks are well protected by precipitous slopes into adjacent gullies. Major occupation platforms stand more than 10 m above a narrow saddle to the south. Higher ground in this direction is reached *ca.* 100 m from the fortification's outer defences. At the north end of the site is another saddle, beyond which a large area of higher ground extends to N108/98. This is the most vulnerable quarter of the pa with an easy approach along the ridge and by way of a moderate slope to the west.

Artificial defence is complex and includes a variety of ring-ditch and transverse works. The site is basically made up of two major independently defensible platforms with other defended occupation areas at lower levels to the north, north-east and south. For the purpose of description, external defensive works will be examined first; internal defences will be examined later in discussion of the various occupation platforms.

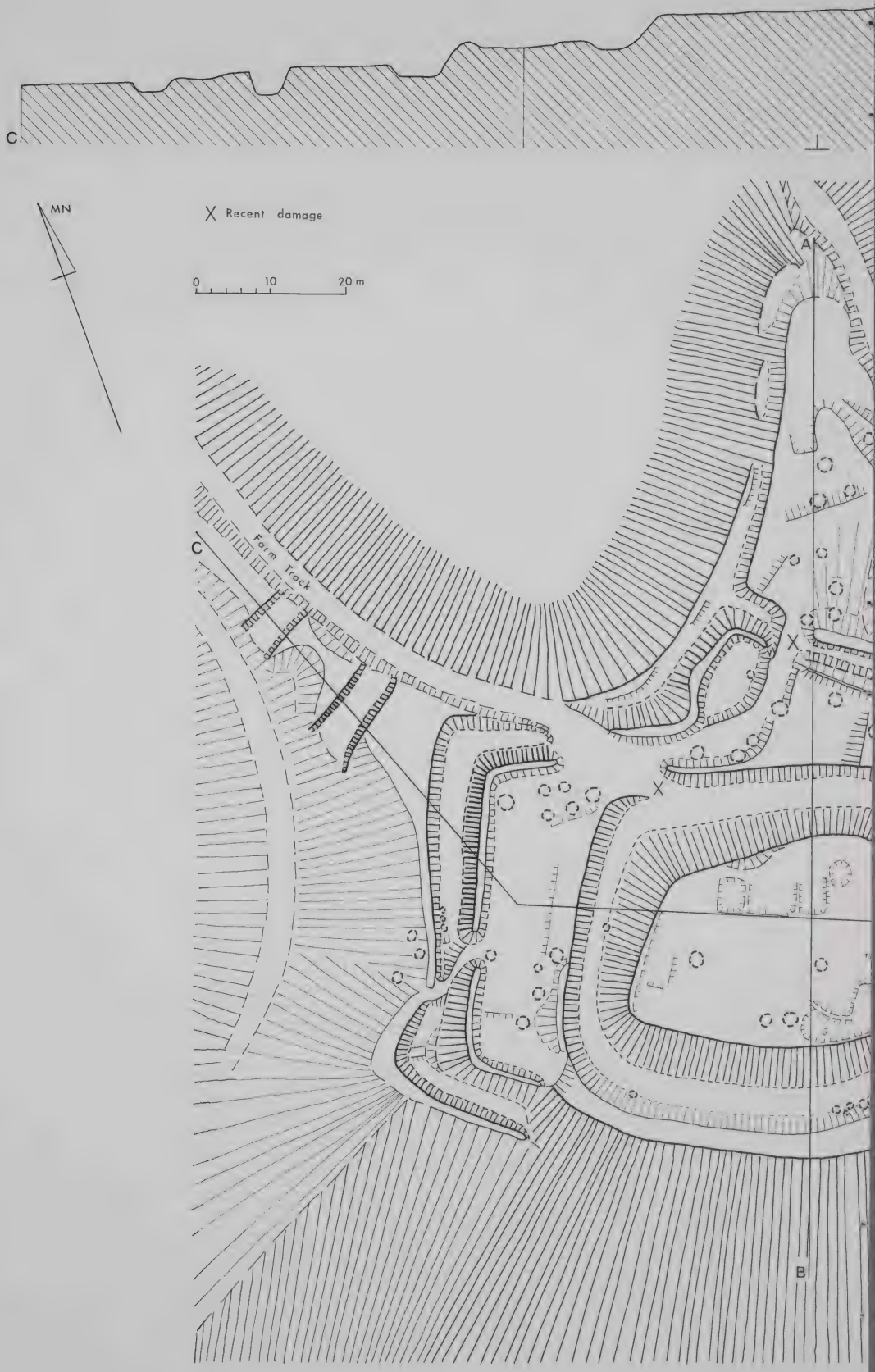


Fig. 2. Plan and section

Manawapo (N108/28).

Figs. 3,4. Manawapo. 3. Aerial view from the south (1974). 4. Aerial view from the south-west (1974). N108/35 can be seen at the end of the spur upper left.

At the vulnerable north end of Manawapo, two major ditches *ca.* 4 m and 6 m across cut the narrow spur. To the rear of these is an abrupt ditch and bank which extends around a large lower platform at this end of the site. Beyond the farm access track, which now cuts this defence, the ditch and bank continues down the flank of an extensive defended area occupying a spur which falls away toward Te Komete Stream. On the other side of this spur no ditch survives: the present bulldozed track along the flank of the pa may make use of earlier ditch and bank defences, but it seems more likely that the precipitous drop into the gully itself provided sufficient defence. At the south end of the site successive terrace and scarp defences, 5, 4 and 2 m in height, confront any advance down the ridge. Above the Timaru River, on the west side, the major artificial defence is provided by sections of ring-ditch defence, now badly damaged in places, which encircle the two major platforms.

Within the fortification are two major occupation platforms, the two ring-ditches of which are separated by a 2-3 m high bank. This bank curves around the higher, southerly, platform, suggesting that this was the initial defence at the site. This higher platform is 16-18 x 28 m (440 m^2) in size. At its south end the ditch does not quite cut the ridge to complete the encircling defence. At the north end the remains of a badly damaged wall can be seen on the platform rim. On the platform are four (perhaps six) *rua*, while slight scarps and depressions indicate preparation of areas for houses or other structures. Below the platform to the south are two subsidiary terraces with scarp defence which give space for a further five *rua*. These two terraces give an additional 450 m^2 living space. The ditch in this part of the site contains four more *rua*.

The second major living platform occupies a central position in the site and may be regarded as the key defended area. The platform measures 20-28 x 28-36 m, giving an area of *ca.* 650 m^2. Around it is a 4-6 m high scarp which falls directly into an unusually massive ditch. At the two ends of the platform are the usual banks which add to the defensive strength of the platform. On the platform itself are at least five *rua*, and several slight terraces or depressions. Especially interesting among the latter are three adjacent rectangular depressions extending along the north-east side. In the ditch which surrounds this platform (and in one place extends out to the eastern side of the ridge) are thirteen *rua*. Following the usual pattern these are generally dug into the foot of the platform scarp or opposite counterscarp.

At the north-west end of Manawapo is a defended occupation area with its rear to the ring-ditch of the central platform and its front and sides defended by a major ditch and bank. The unusually strong bank stands 1 m above the defended area and 4.5 m above the bottom of the external ditch. The platform is more than 40 m long and 12-16 m wide, giving a living space of *ca.* 480 m^2. There are eleven *rua* on the platform itself and a further six in the ditch outside and on the adjacent approach to what appears to be original access into the pa.

A major subsidiary defended area is located on a spur which dips north-eastward to the valley of Te Komete Stream. Here an upper platform sloping to the north-west is separated by a ditch and bank from a more extensive, lightly defended area which occupies the top of the lower spur. The upper platform is about 12-18 x 36 m (*ca.* 500 m^2). At its north-west extremity it extends to the adjacent north-west platform. The ditch and bank which runs without a break around both these platforms provide a major line of defence forward of the key inner platform and barring the most vulnerable approach to the

fortification. The farm track which now cuts the defences where these two platforms meet has uncovered a stone-lined hearth situated next to the former bank. The living area south of this has its sloping platform divided into several major terraces occupied by a total of eight *rua* and some minor platforms and terraces. A massive pit at the lower end of the platform appears to be a modified natural feature. Beyond the ditch and bank defence of the north-east flank of this platform the spur slopes away for more than 40 m before dipping sharply to the stream. Here is a lightly defended area of *ca*. 650 m^2 occupied by several terraces and nine or ten *rua*.

The massive and complex defences and the size of the defended area make Manawapo one of the outstanding pa of the entire survey area. The ditch and bank defences of the north end extend 40 m forward of the living area and 65 m forward of the central inner platform, while at the south end, terrace and scarp defence 50 m deep must be overcome before the smaller inner platform is reached. The fortification extends 190 m along the ridge and as much as 110 m across it. The total area of the site is *ca*. 8000 m^2, of which the available living space makes up *ca*. 3300 m^2. It must, however, be borne in mind that ditches could have uses other than simply for defence: for example, on Manawapo at least twenty *rua* are cut into ditches. The total of almost 70 *rua* recorded on the site must be a minimum number, with many others now hidden, especially at the favoured location at the foot of the scarps.

N108/35 (514791) Fig. 5

N108/35 is situated at the end of a spur which extends northward between two branches of Te Komete Stream. Approximately 300 m to the south is the major fortifica-

Fig. 5. N108/35 — aerial view from the south-east (1974). The picture shows the site before it was substantially damaged in 1976.

tion of Manawapo. The pa occupies a surprisingly commanding position above adjacent gullies and terrace country to the east and west. In the 1950 aerial photograph (1790/8) the site is invisible under pines. Some time before I first visited the site in late 1974 the pines were removed with some damage done to the defences. In 1976 earthworks for the Maui gas pipe line saw part of the spur cut down 4-5 m and half the fortification completely destroyed as a result. What remains is under pasture.

Natural defences of N108/35 consist of steep 20 m falls into gullies on both flanks. At the north end is an easy approach from the stream fork, while the southern end offers no natural obstacle to an approach down the flat topped spur. Artificial defences appear to have consisted of a single ring-ditch which encircled the large occupation platform cutting through the spur where it narrowed at the south end. A bank of the usual form topped the platform rim at the vulnerable south end.

The single occupation platform of this pa was 20-30 x 45 m, giving a defended area of *ca.* 1100 m^2. Approximately 23 m now remains of the length of the platform, with what remains having a maximum width of 29 m. No *rua* or other evidence of internal organisation are visible on the remaining platform.

N108/98 (510793) Figs. 6, 7

N108/98 occupies a spur end between Timaru River and Te Komete Stream — the spur now cut below the site by the main road. The site is in good condition under grass. Remnant native bush, including rewarewa, lancewood, rimu and kawakawa, survives on the steep slope to Te Komete Stream.

The pa holds a naturally strong high point at the north end of a ridge which is also occupied by the great pa Manawapo *ca.* 700 m to the south. It completely commands the lower ground south along the ridge, as well as the westward slope down to the Timaru River. The marginally higher terrace edge to the north-east is 100 m away across the 20 m deep gully of Te Komete Stream. Artificial defences consist of a single ditch which rings the site except possibly at the precipitous eastern side. The platform rim rises to be almost a metre above the platform at the vulnerable south end of the pa. A causeway crossing the ditch at the north end appears to be an original feature.

Within the defensive bank at the platform rim the effective occupation area is *ca.* 540 m^2 (18 x 30 m). Six holes are dug into the site along the eastern and western margins of the platform and, on the eastern side, a little below. These are 1.2-1.5 x 2.5-3 m in size and are mostly *ca.* 1 m deep. Local knowledge indicates they are Second World War rifle pits and their command of the main road support this. Just outside the pa defences at the south end, on the west side of the spur, is a single terrace *ca.* 4 x 2 m.

N108/119 (508798) Figs. 8, 9

This unusual fortification is situated on top of a 30-40 m cliff on the right bank of Timaru River. It is visible over the river from the main road. Six hundred metres to the north is the now destroyed pa N108/173, while 400 m south, across the gully of Te Komete Stream, is N108/98. The present landowner reports former extensive shell middens at the western margin of the terrace to the north. The site is in good order. A farm road cuts the eastern defences; it is reported that some cutting away of the inner platform has occurred next to the road and that at least one hole on the site is a Second World War

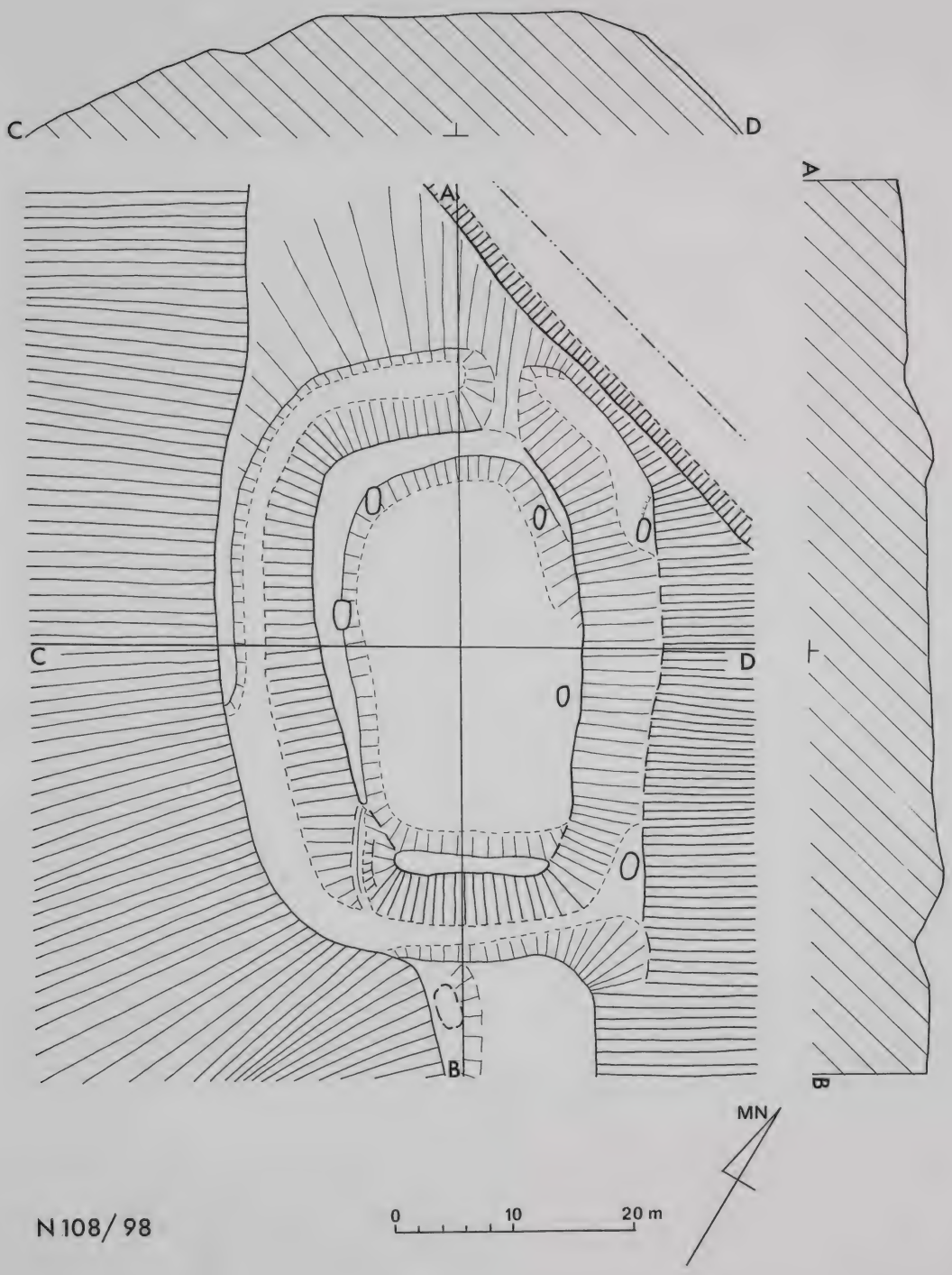


Fig. 6. Plan and sections of N108/98.

Fig. 7. N108/98 — aerial view from the east (1974).

rifle pit. The site is now under pasture with a solitary rewarewa standing on the outer platform. Some karaka, mahoe and kawakawa survive on the south and east margins of the inner platform, and macrocarpa trees stand on the south-east transverse defence.

N108/119 occupies the narrow southern point of an extensive terrace. Natural defence includes the cliff to the river south of the inner platform and a steep scarp to the riverside flat along the west side. To the east is a broad gully *ca.* 10 m deep. The fortification has two separate defensive works enclosing two platforms. An outer ditch and bank extends from the scarp on the west side of the site, around the outer platform, to disappear where it is now cut by the farm track. At the centre the counterscarp is 1.5 m high and the main scarp to a substantial bank is 2.5 m. At the rear of this platform is a more massive defensive work enclosing the inner occupation area. Here the ditch extends around three sides, from cliff to cliff. The main scarp is more than 4 m from the bottom of the ditch to the top of an inner bank which continues strongly around two sides. A now shallow transverse ditch cuts the low cliff-top ridge south-east of this platform.

Of a total area taken up by this pa of *ca.* 3500 m^2, the two occupation platforms together total less than 1000 m^2. On the strongly defended inner platform of *ca.* 300 m^2 are six *rua,* and a large open pit which may be a collapsed *rua,* or perhaps the Second World War rifle pit. On the outer platform of *ca.* 625 m^2 are only two *rua.* Both platforms possess slight scarps forming terraces for surface structures. The outer platform has the appearance of providing additional living space, some time after the throwing up of the inner position as the initial fortification at the site.

N108/173 (507805)

Weld Road cuts through a Maori fortification *ca.* 700 m towards the sea from the main road corner. The work was strategically situated on a narrow ridge between

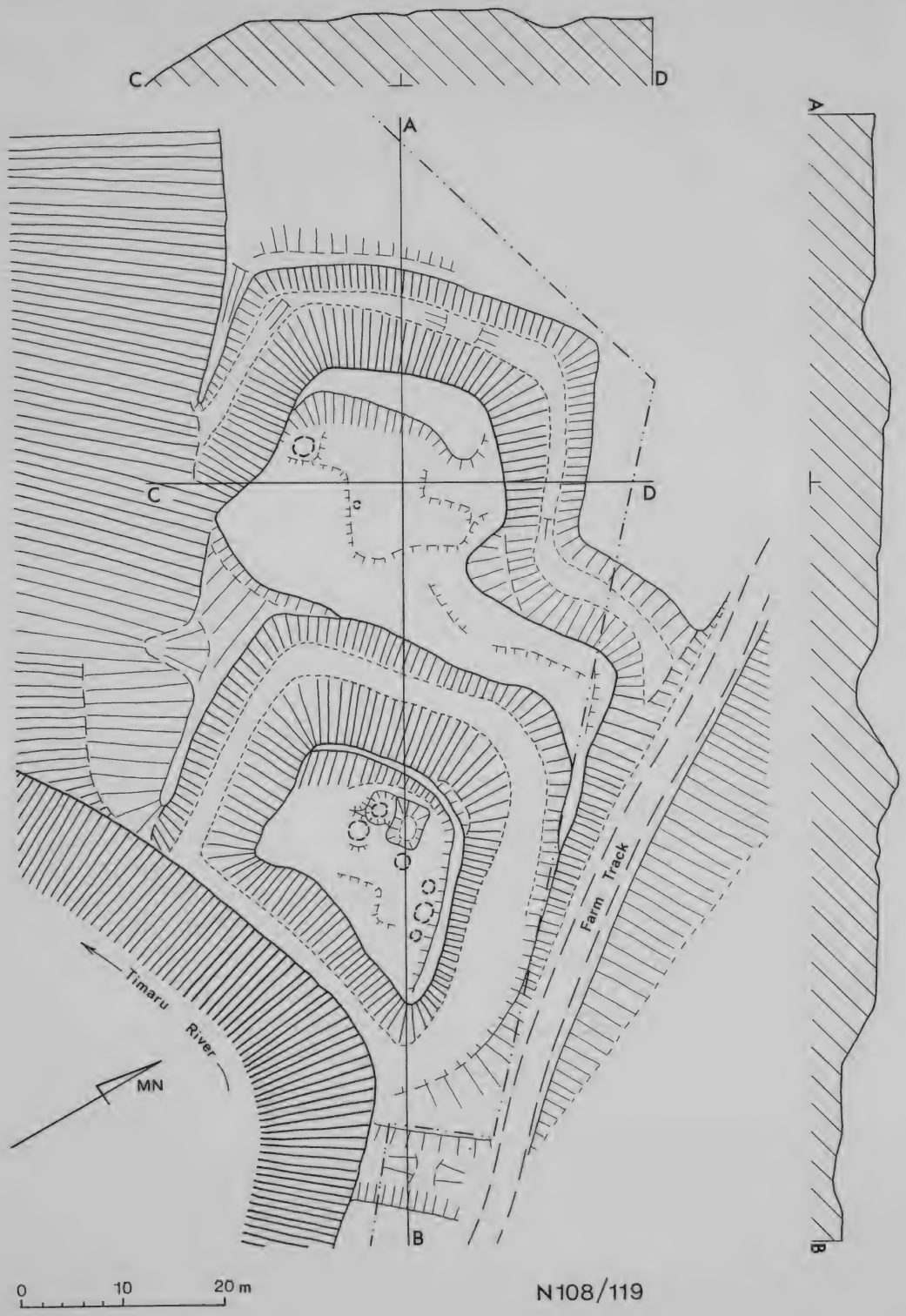


Fig. 8. Plan and sections of N108/119.

Fig. 9. N108/119 — aerial view from the east (1974).

Whenuariki Stream and a minor tributary of Timaru River. It thus holds the route by the easy terrace country up the right bank of Timaru River to the great fortification of Manawapo less than 2 km to the south. In the 1950 aerial photograph (1790/8) the site shows clearly under pasture and scrub. The road trims off the west side of the occupation platform and cuts through the defences at each end; the remainder of the pa is intact. The site was completely destroyed in the early 1950s. All that survives is the very faint suggestion of an infilled ditch east of the road.

N108/173 occupied a commanding situation, not only dominating the 15 m deep gullies east and west, but possessing a useful view over the extensive terrace country south to the ranges and for some distance north. To the west it also commands the valley of the Timaru River with the nearby pa N108/171 low on the right bank. The aerial photograph shows a roughly four sided ring-ditch work with an additional transverse ditch at the north end. The single occupation platform appears to have been *ca.* 12-15 x 25 m giving an area of perhaps 300 m^2.

N108/171 (505806) Figs. 10, 11

This tiny fortification stands on a 20 m cliff above the right bank of Timaru River (where the river takes a great loop so that it actually flows southward below the north-east flank of the site). It is visible from Weld Road where the road cuts through the nearby pa N108/173. The site is now under pasture with native vegetation clinging to the cliff below,

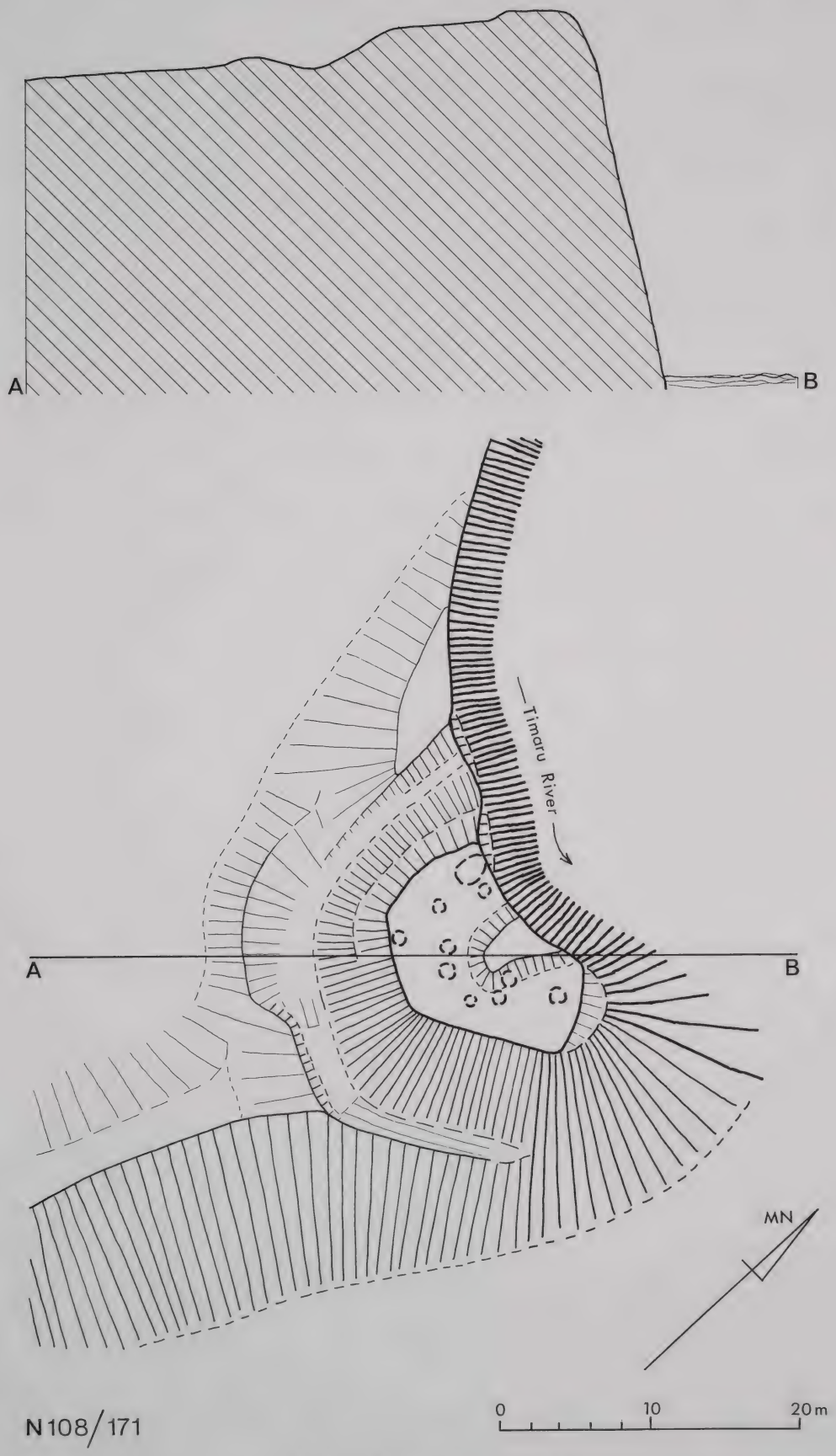


Fig. 10. Plan and section of N108/171.

Fig. 11. N108/171 — view from the south-west (1980).

and remnant ponga, mahoe and other species surviving on the steep hillside to a lower river flat to the south-east. N108/171 is in excellent condition: limited damage to the lower parts of the outer bank is probably the result of recent cultivation.

The fortification occupies the corner of a spur which runs south from nearby higher ground, and then south-west for 40-50 m before dropping to the river. Strong natural defences are provided by the cliff to the rear and by the precipitous 15 m scarp south-east to a lower river flat. The platform has a slight advantage over the nearby spur for 20-30 m before the spur rises to the north to completely command the site. The platform stands 4-5 m above the adjacent river terrace to the west. Artificial defences comprise a single ditch which runs from the cliff on the north side of the platform, around the west and south-west sides, and then runs out some 10-12 m down the steep scarp to the lower flat. Most of the defence of the precipitous south-east flank is thus left to the natural scarp. The platform scarp of the west side is 3 m high.

The occupation platform is only 9 x 15 m at its greatest extent. The defended area is perhaps 90 m^2, this area being further reduced by a block of ground at the rear which is 60 cm higher than the remaining usable platform. On the platform are ten *rua* which together leave little room for surface structures. It seems likely this fortification served simply to store food grown in adjacent gardens in the sheltered valley bottom.

N108/172 (505817) Figs. 12, 13

N108/172 is located on a broad spur on the right bank of Timaru River *ca.* 2 km from the sea. Its situation is low in the river valley with a useful view only over flats in the valley bottom, especially north towards the river mouth. In the 1950 aerial photograph

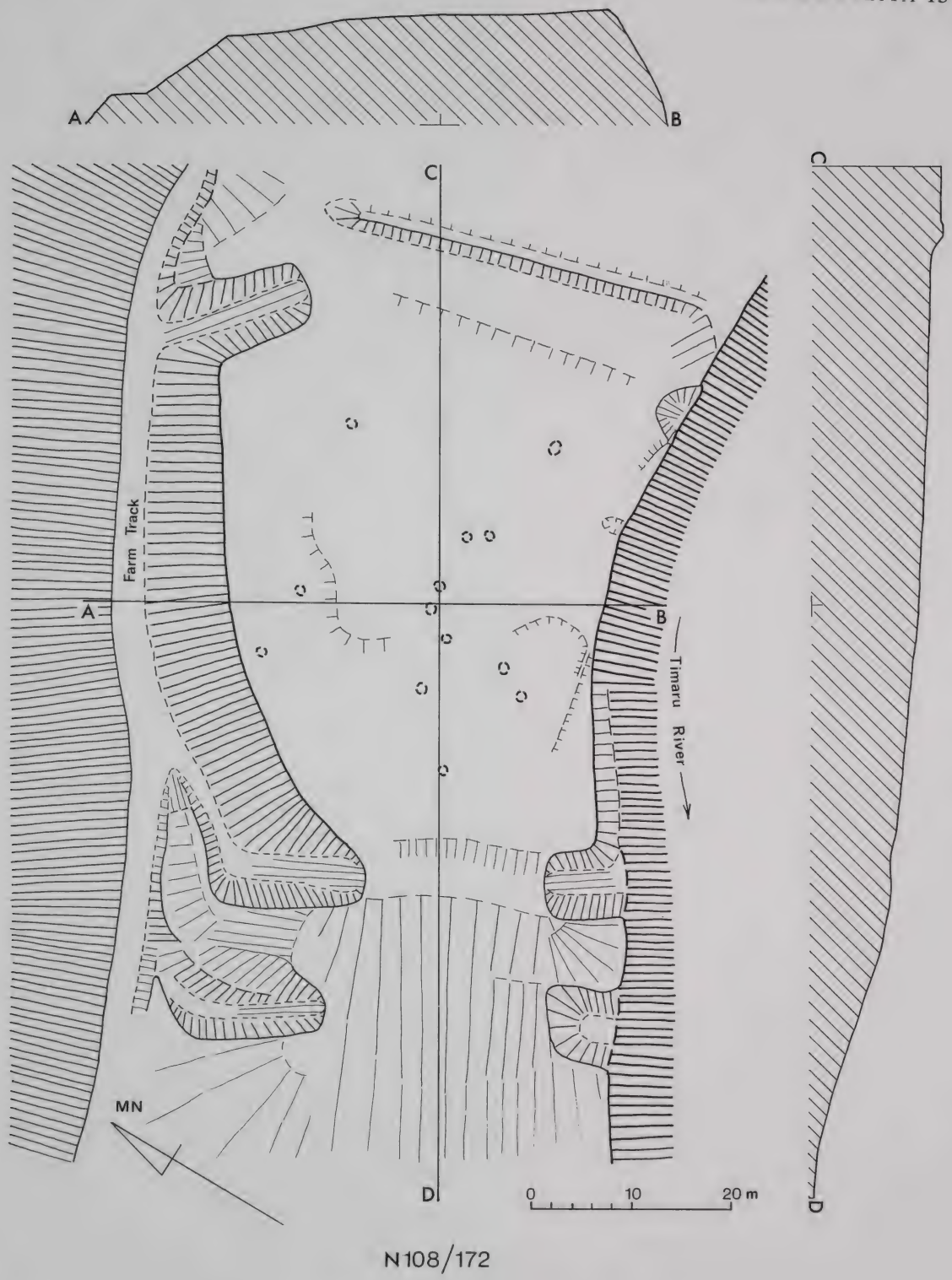


Fig. 12. Plan and sections of N108/172.

Fig. 13. N108/172 — aerial view from the north-east (1975).

(1789/6) it is clearly visible under light scrub. Since then, however, the scrub has been removed and the transverse defences substantially damaged. The lateral ditch along the north side has also suffered damage and now provides the basis for a farm track down the spur. Damage to the living platform is less clear. The site is under grass.

Natural defences consist of a 20 m cliff to Timaru River on the south side and a precipitous 20 m scarp northward to an extensive river flat. To the west transverse defences cut the broad spur where its generally easy slope makes a slight dip. At the east (up-spur) end the easy approach offers no assistance to artificial defences. A ditch and bank extends around three sides of the pa. Along the north side the ditch is 6 m below the platform rim. The existence of the outer bank here can be noted from the 1950 aerial photograph although its precise nature can no longer be determined. At the east end difficult remaining evidence suggests there was only one transverse ditch with a bank *ca.* 8 m forward of it to act as additional defence. It is possible, however, that this bank relates to a second ditch — the aerial photograph is unclear on the point. At the west end a second ditch cuts the spur to give 20 m depth to the defences, adding weight to the possibility of there being a second ditch at the more vulnerable east end as well.

The occupation platform is 24-42 x 48-54 m, allowing a defended area of *ca.* 1800 m^2. Occasional very slight scarps survive on the platform which dips to the west. Thirteen *rua* may be representative of more which are now invisible following the general damage to the site.

N108/60 (509837)

Until recent years the remains of a large pa could be seen cut by Weld Road and taking up the narrow seaward end of the ridge between Whenuariki Stream and the right bank of Timaru River. The fortification is now virtually destroyed, although difficult surviving evidence, along with the 1950 aerial photograph (1788/4), does allow some reconstruction of what once existed. Only a 2 m length of the southern defensive ditch remains untouched between the road cutting and the adjacent fence. The site is now under grass.

Natural defences of N108/60 are strong, with a narrow waist of land connecting with the terrace country to the south and steep slopes to the valleys east and west. To the north the spur dips towards the beach about 200 m away, rising again over a low saddle to a knoll which has terraces but no sign of related defence. Artificial defences appear to have consisted of three successive transverse ditches at the south end over a total depth of more than 70 m, with the inner bank and platform scarp the most massive. These are clear in the 1950 aerial photograph although Weld Road, where it dips to the beach, has already destroyed the west end of the outer bank. A terrace runs along the east flank and north end of the occupation platform providing two scarps for terrace and scarp defence. Above the precipitous west flank is a single terrace and scarp defence.

It is difficult now to establish the size of the occupation platform of this pa. The triangular inner platform appears to have been *ca.* 75 x 135 m in size, with additional living space north and west within the destroyed terrace and scarp defensive works. To the south the 20 m and 40 m gaps between successive transverse ditches also offer living space, especially on the substantial 22 x 40 m platform within the outer ditch. The defended area may total between 5500 and 6000 m^2.

Pukewaranga N108/63 (487785) Figs. 14, 15

Pukewaranga is located on a prominent hill which stands above the surrounding countryside in the headwaters of the Pitone Stream, *ca.* 200 m east of Lower Pitone Road. The site is now mostly under pasture. Remnant native trees include karaka, ngaio, mahoe, kawakawa and ponga on the scarps, and scattered kawakawa and mahoe on the platform. Three massive pines dominate the southern corner of the site. The earthworks are mostly in good order with some erosion of the steep scarps which appears mostly to have been initiated by stock. Three stock tracks, which may follow older access to the platform, pierce the rim near the north-east corner. Quarrying for fill below the north-east end of the site appears to have left the defences undamaged.

This fortification occupies a strong situation on top of a commanding hill, with excellent views all round, especially to the north and west. To the east the defences fall steeply away *ca.* 30 m into the neighbouring gully. Westwards is a drop of 15 m to uneven terrace country which extends beyond the present road to the rim of the Katikara River valley some 300 m away. The nearest ground higher than the pa is *ca.* 150 m to the south. Major artificial defence consists of a single encircling ditch and bank. The ditch is well formed and massive, as much as 10 m across, with a counterscarp up to 2 m and a main platform scarp of between 3 and 4.5 m. Present indications are that access into the ditch was at the south and east corner. At the platform rim is a substantial defensive bank, 1.6 m above the adjacent platform at the higher south-west end of the site, and up to a metre high along the north-west side. A bank also appears as a slight rim on the south-east margin and is again barely visible at the north-east end.

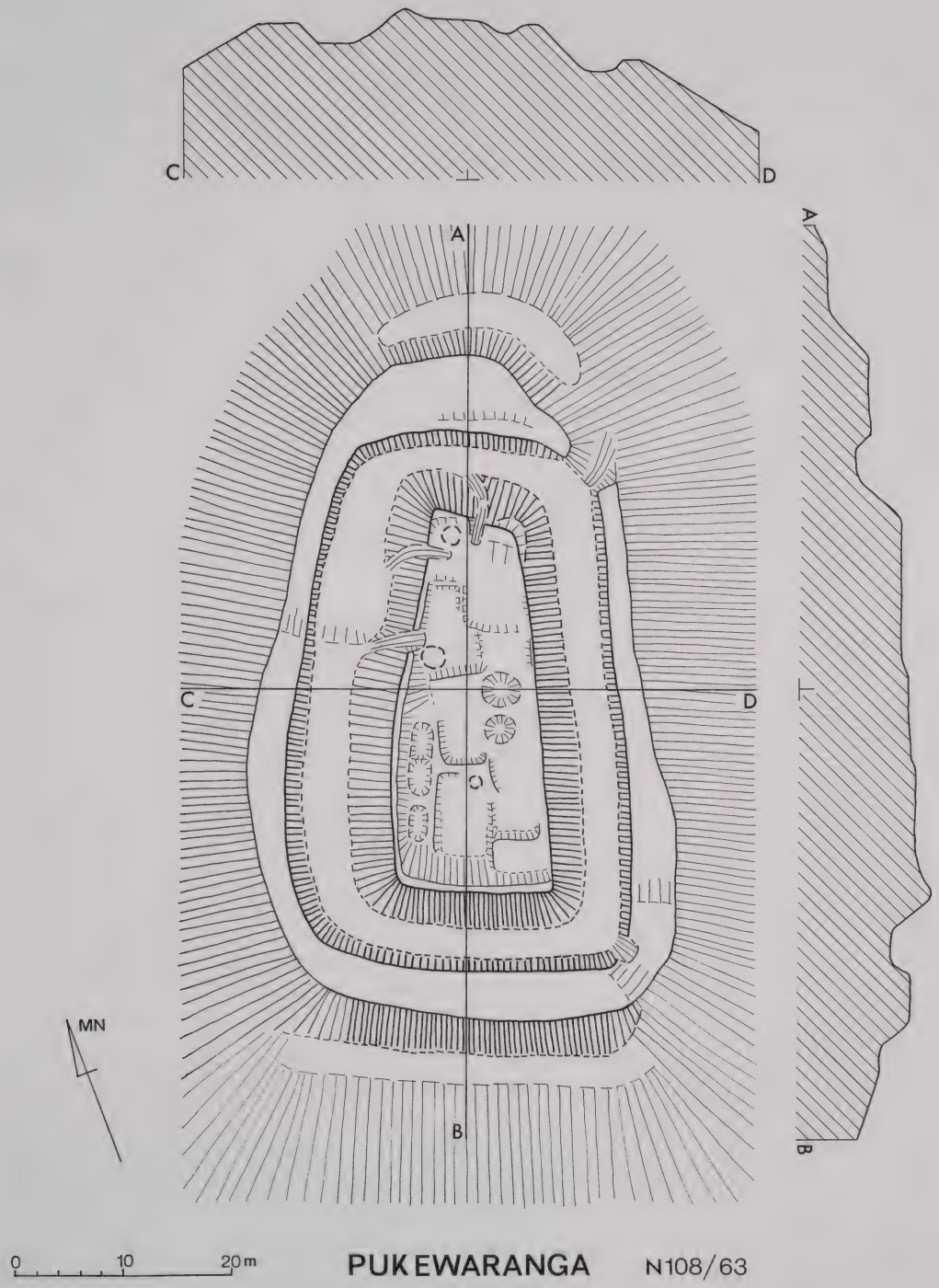


Fig. 14. Plan and sections of Pukewaranga (N108/63).

Fig. 15. Pukewaranga — from the south (1981). N108/64 is beneath native bush to right.

The occupation platform of Pukewaranga is 8-14 x 34 m, giving a defended area of *ca.* 425 m^2. The platform dips almost a metre from the south-west end to the north-east, and also falls away across the site from the defensive bank of the north-west side. On the platform are a number of prepared terraces separated by minor scarps or banks. At least five such terraces provide space for a rather greater number of houses or other surface structures. Dimples of the usual form indicate three *rua,* while another two massive holes up to a metre deep may indicate collapsed *rua* or perhaps open pits. Three elongated pits at the western corner of the platform appear to owe their origin to open pits of a rectangular plan. A marked terrace which curves more than 20 m around the face of the hill outside the defences of the north-east may have provided additional occupation space, or may be connected with access through the defences nearby.

Pukewaranga is markedly similar to the nearby fortification of N108/64 at the head of the adjacent gully *ca.* 400 m to the north-east. Both sites have massive ditches defending occupation platforms of *ca.* 400 m^2, and both have unusually large defensive banks on their platform rims. On their occupation platforms the two pa share complex terracing arrangements, and pits of two uncommon forms: the deep square open pit and shallower, elongated open form. Their proximity to one another and their common features combine to suggest a close historical association.

N108/64 (491789) Fig. 16

N108/64 is located at the head of a minor tributary of Pitone Stream, between Pitone and Timaru Roads, *ca.* 3.5 km from the sea. The site is on a slight spur which divides the valley. It is now under bush, except for the outer ditch and bank of the south end which is under grass and the adjacent bank under gorse. Karaka and kohekohe make up most of the canopy with karaka predominant, including many large trees on the occupation platform

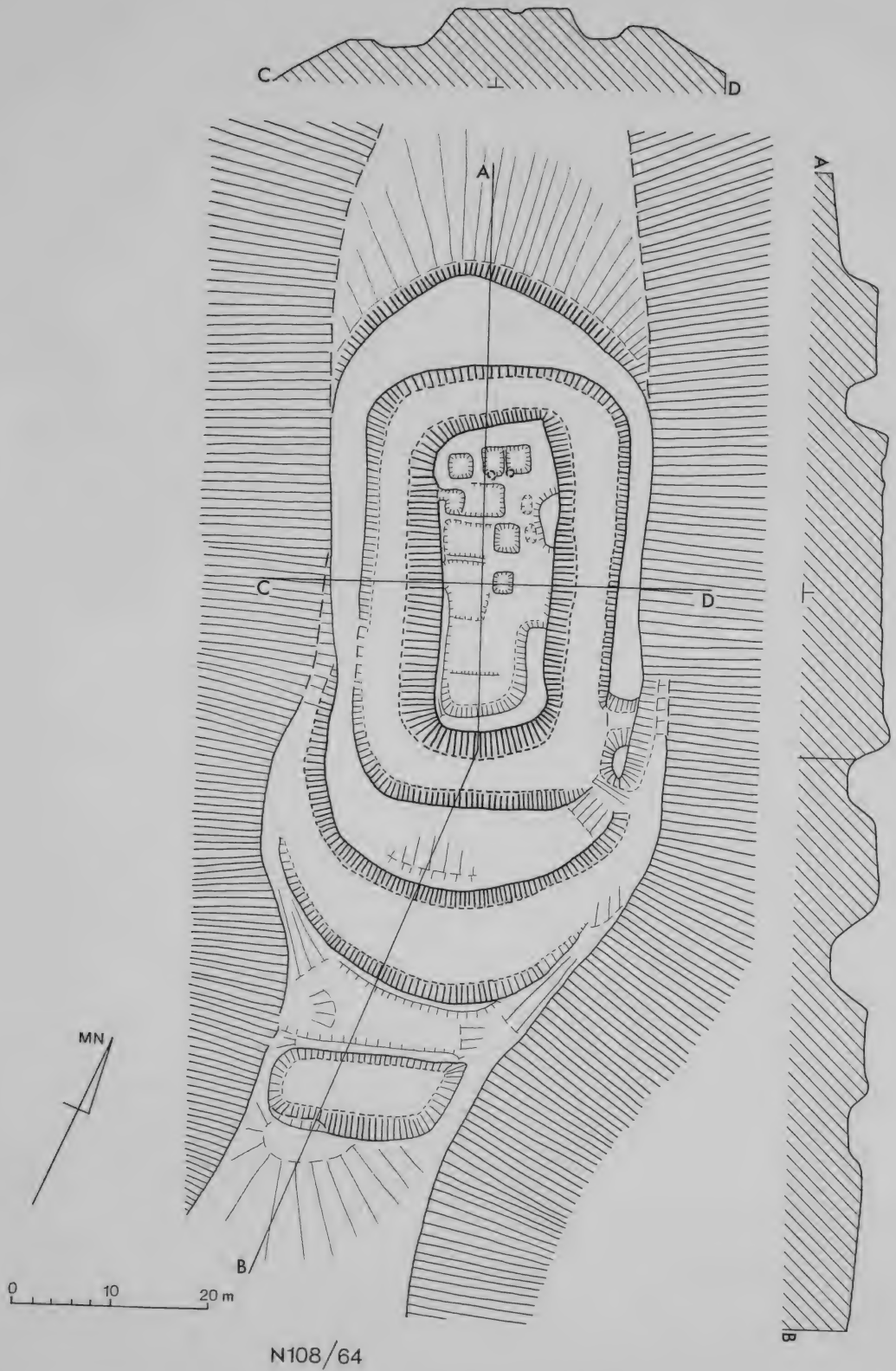


Fig. 16. Plan and sections of N108/64.

rim and the encircling scarp. Understorey vegetation includes mahoe, mapou, hangehange, kawakawa and mamaku. The site is generally in excellent condition with almost vertical scarps still abundant. It is, however, open to stock which are causing some severe local damage.

This pa occupies a typically low-lying situation 6-10 m below the general level of the surrounding terrace country. At the south end higher ground is *ca.* 50 m away over a slight saddle. Both flanks of the site drop steeply 8-10 m into narrow gullies, beyond which the higher terrace edge is *ca.* 60-80 m from the occupation platform. At the northern, down-spur, end a relatively easy slope extends *ca.* 40 m down to the fork of the stream. Artificial defences consist of a ditch and bank which ring the occupation platform, with two additional ditches securing the vulnerable south end. The outer transverse ditch at the south end is 1.5 m deep. It does not quite cut the spur, and so allows access at both ends into the fortification. Between this and the second transverse ditch is a bank 6-9 m broad with a slightly raised rim at both margins. The second ditch is up to 4 m deep. The next bank here is under dense gorse: what investigation was possible suggests a marked decline from a high outer rim to the top of the inner scarp. The occupation platform itself is surrounded by a scarp 4-4.5 m in height. Much of its rim is surmounted by a marked bank which is as much as 60 cm high at the south end.

The powerful defences of this site defend a rectangular occupation platform 11-12 x 31 m, *ca.* 350 m^2. On this platform is considerable evidence of internal organisation including slight scarps and banks dividing off rectangular areas which it may be presumed were prepared for houses or other structures. Four large square pits about 1 m deep defy easy interpretation — they may be for storage, but are quite unlike the usual underground *rua* used in Taranaki for this purpose. Two of them provide access into deeper *rua*. Two other square depressions are not as deep. Two smaller open pits are about 1 x 2 m.

N108/120 (486797) Fig. 17

N108/120 is located within a fork of Pitone Stream *ca.* 2.5 km from the sea. In the 1950 aerial photograph (1790/6) it shows up well under gorse; it has since been virtually destroyed. The remains of the site are under pasture.

This pa is situated on an unusually low spur end within a gully. It is dominated from higher ground at both sides and commands only the undulating spur southwards which extends 100 m before rising above the site. The occupation platform appears to have been only 5-10 m above the bottom of adjacent gullies. Artificial defences can be determined by means of the 1950 aerial photograph and surviving surface evidence. Defences apparently comprised a single ring-ditch with an additional transverse ditch across the spur at the north end. The outer ditch here is 27 m long and may have extended almost to the bottom of the now swampy valley to the west.

The defended area is no longer level but now rises to a regular mound, no doubt the result of the former platform margins having been pushed into the encircling ditch. The occupation platform can be determined as 11-18 x 30 m, giving a defended area of *ca.* 450 m^2.

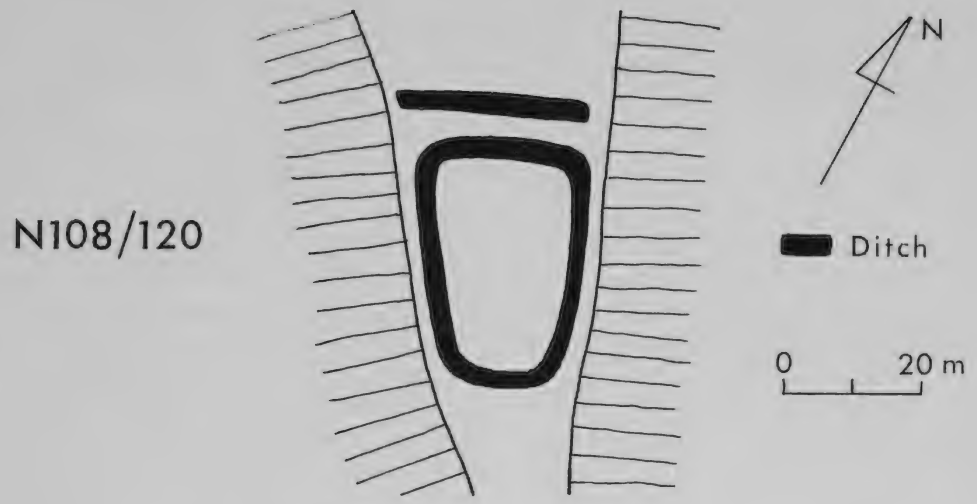


Fig. 17. Reconstruction of defences of N109/120.

Wakamakau N108/178 (483798)

'Wakamakau' is marked on Blocksheet Cape II (14/4) where it is depicted in the stylised form of a rectangular earthwork. It is located on a prominent hill which rises 10 m above the general level of the surrounding terrace country on a narrow ridge between the Hurumangu tributary of Waiaua Stream and the westernmost tributary of Pitone Stream. The site is a commanding one with extensive views all around and useful natural defence on all sides, especially to the east and north. It is impossible now to determine from surface evidence what might have been here. All that survives is the faintest suggestion of a former ditch along the north and west sides of the hill top.

N108/168 (495793) Fig. 18

N108/168 is located at a narrow point in the ridge which divides the two major branches of Pitone Stream. It thus holds a narrow way between the extensive terrace country about the main road to the south and east, and the broad ridge which extends almost 2.5 km north to the fork of the stream. N108/99 is 300 m north across the adjacent gully, and N108/64 is *ca*. 500 m south-west. The site is almost completely destroyed. All the occupation platform, except an area *ca*. 8 x 8 m which supports a large pine, has been cut down by as much as 3 m. The defences of the south side are completely demolished by an access track, already apparent in the 1950 aerial photograph (1790/8). Defences have also suffered greatly elsewhere; only a short section adjacent to the surviving platform remains intact.

At the north and south flanks excellent natural defence is provided by steep falls into adjacent gullies. Both ends of the pa are somewhat vulnerable, however, with easy approaches from the west and from higher ground *ca*. 80 m up the ridge. Archaeological evidence indicates a fortification of typical form with a single ring-ditch, supplemented by an outer transverse ditch at each end. The surviving defensive works of the east end begin with a 1 m high bank, followed by the outer ditch, a 1.5-2 m high bank, the inner ditch,

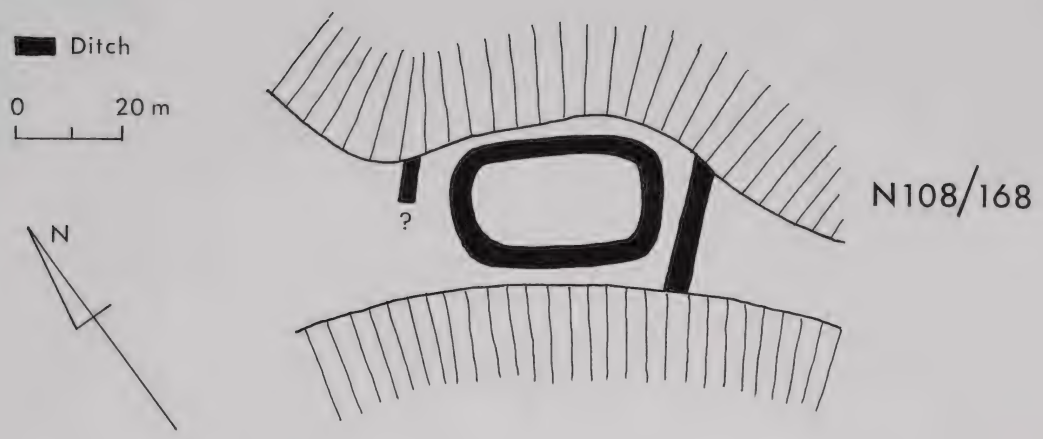


Fig. 18. Reconstruction of defences of N108/168.

and a platform scarp of 4.5 m. On the north side of the site the remains of the ring-ditch indicate an occupation platform perhaps 12-16 x 32 m (*ca*. 450 m^2). Of the living area of the pa nothing more can be said.

N108/99 (495796) Figs. 19, 20

This pa is strongly situated on a prominent hill which stands between two tributary gullies of Pitone Stream almost 3 km from the sea. Nearby to the north and south are N108/169 and N108/168. Mature pine and macrocarpa trees stand in the inner ditch and on the adjacent scarp. The occupation platform is under poor pasture and blackberry. The outer ditch is under pasture. The site is at present in fair condition, although stock are breaking down the platform scarp very badly in places.

N108/99 stands on a somewhat isolated piece of ground between two gullies. It has good command over adjacent gullies and beyond, while to the south a low and narrow ridge connects the site to nearby terrace country. Artificial defences comprise a rare example of double ditch and bank for much of the circumference. The fortification's situation on a knoll, rather than a ridge, has required that the outer bank is more than a simple transverse work and that it extends for much of the way along both sides. Platform scarps are 2-4 m high. At the north end of the platform is an unusually massive bank almost a metre high. An almost equally high but not so massive bank tops the platform rim at the south end. A rim bank also survives in places along the two sides of the platform.

The unusually strong defences of this site make up most of the total area of *ca*. 2400 m^2, and enclose a rectangular occupation platform of only *ca*. 350 m^2 (15 x 23 m). The occupation platform is level within the rim banks and gives no sign of interior organisation except for five *rua* scattered across the centre. Outside the outer bank at the north end is a single terrace.

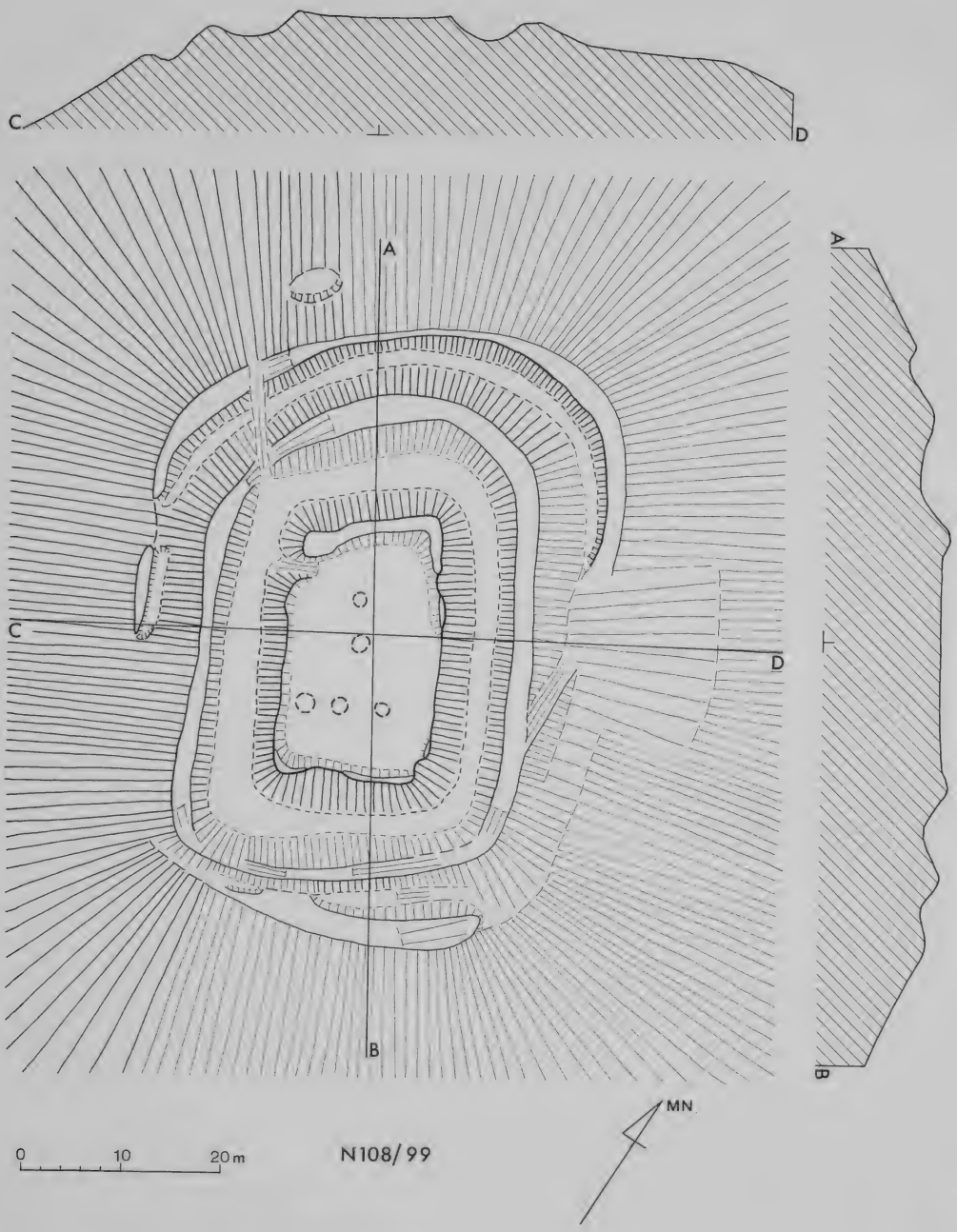


Fig. 19. Plan and sections of N108/99.

Fig. 20. N108/99 — view from the north (1980).

N108/169 (495798) Fig. 21

N108/169 is located on a low spur end on the right bank of the right branch of Pitone Stream, *ca*. 200 m north of N108/99. The site is now under pine and macrocarpa trees. Stock have been 'camping' on the platform and breaking down defensive scarps. Some bulldozer work has damaged the defences of the north-east flank.

Steep falls of 8-10 m into adjacent gullies give useful natural defence at both flanks. Up the spur, however, rising ground commands the platform from only a few metres beyond the counterscarp, while an easy approach from the gully fork offers little security against an approach from that direction. Nor are artificial defences strong, consisting as they do of what appears to have been only a simple ring-ditch work, aided at the south-east (up-spur) end by a 60 cm high bank on top of the platform scarp. The ditch is strong and wide at both ends but is unclear down the flanks with the outer bank having been destroyed to the north-east, and remaining only as a slight rim along part of the other side. Platform scarps are between two and three metres.

The occupation platform is 10 x 21 m, giving an area of no more than 200 m^2. It dips to the north-west and is divided in two by a 50 cm high scarp. The lower, marginally larger, terrace has further evidence of internal organisation in the shape of a slight scarp dividing off a subsidiary platform *ca*. 5 x 5 m.

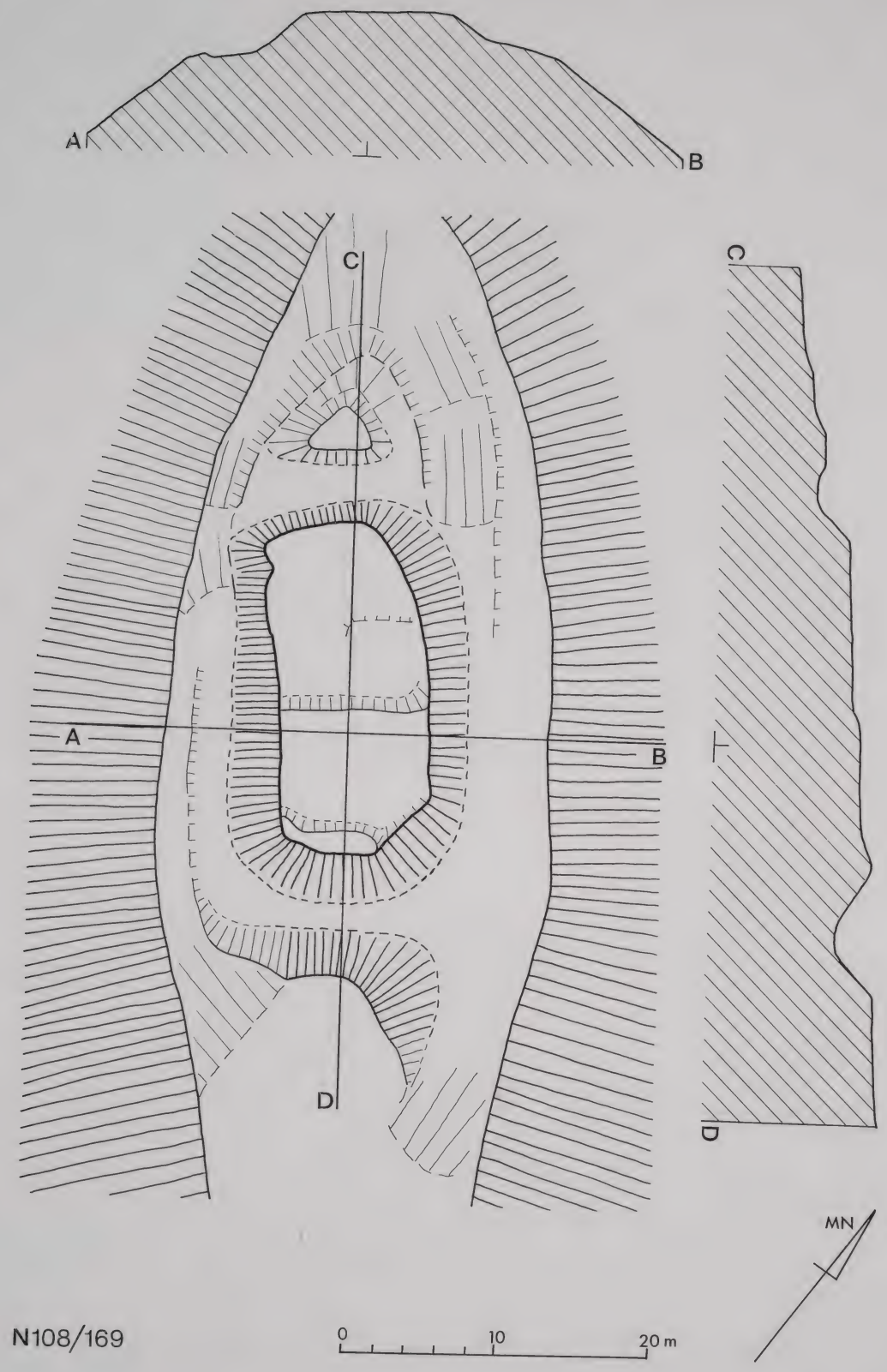


Fig. 21. Plan and sections of N108/169.

N108/170 (497805) Fig. 22

N108/170 is located on a narrow spur just west of Lower Timaru Road near the Greenwood Road corner, *ca*. 2 km from the sea. The spur runs northward between two tributaries of Pitone Stream. In the 1950 aerial photograph (1790/8) the site can barely be seen under gorse; the farm track which runs down the spur below the site on the north-east side is already present. Since 1950 the gorse has been removed and the site is now under pasture. The farm track has done at least some damage to the north-east side. Very severe damage to the site is now being done by cattle: defensive scarps are almost everywhere in a state of active erosion.

Natural defences of this pa are good, with precipitous drops of 6-12 m into gullies on both sides and at the north-west end. Only at the south-east end is there an easy approach from nearby terrace country. The platform commands a useful view over adjacent gullies and terraces. Artificial defence is strong. Three successive ditches and banks bar the vulnerable south-east end, the ditches now 1 m, 1.5 m and 3 m deep respectively. The outer ditch appears to have not quite cut the spur. Lateral defence was probably of ditch and bank form although this is no longer clear. At the north-west end are two transverse ditches and a steep scarp down to the valley below. A massive bank tops the main platform rim at the south-east end.

The unusually narrow site has two occupation platforms. The main, upper, platform is 6.5 x 33 m (*ca*. 210 m^2). A 60 cm scarp across the centre divides it in two. On the upper half are four *rua* and two large depressions 30 cm and 40 cm deep. On the lower terrace are two *rua*. A second platform, 7 x 10 m (*ca*. 60 m^2) is separated from the main platform by a wide ditch, now 2 m deep. On it is a *rua*, a rectangular depression 4 x 4 m, and the remains of two stone-lined hearths eroding from a damaged scarp. The surviving part of one hearth suggests eight or more river stones were used in its construction. Within a total site area of *ca*. 1700 m^2 living space on the two platforms is only 270 m^2.

N108/166 (490813) Fig. 23

N108/166 is situated on a spur which extends from terrace country between the two main branches of Pitone Stream, northward down to the shorter right branch. It is *ca*. 1.2 km from the sea, 2-300 m from N108/165 and N108/167. The site is unclear beneath gorse in the 1950 aerial photograph (1789/4). Since then it has been badly damaged by bulldozer work, mostly down the west side where an unusually wide farm track has been formed. Defences are now under pasture and gorse, with the platform, which is inaccessible to stock, obscured beneath dense bracken, some blackberry and gorse. A few karaka, mahoe and mamaku survive on the platform rim and scarp.

The platform commands a useful view over adjacent gullies and terraces. Natural defences are mostly dependent on steep 10-15 m slopes into gullies east and west. The approach up the spur from the north is not difficult, while the defences at the vulnerable south end cut the site from an extensive level area immediately beyond, which is no lower than the site itself. Artificial defence is made up of an inner ring-ditch with additional transverse ditches cutting the spur at both ends. The 1950 aerial photograph suggests that at the south end the lateral ditches extended unusually into both transverse ditches. The platform scarp is *ca*. 3 m high all around. A bank more than 1 m in height tops the platform rim at the south end and extends at least part way down the west side.

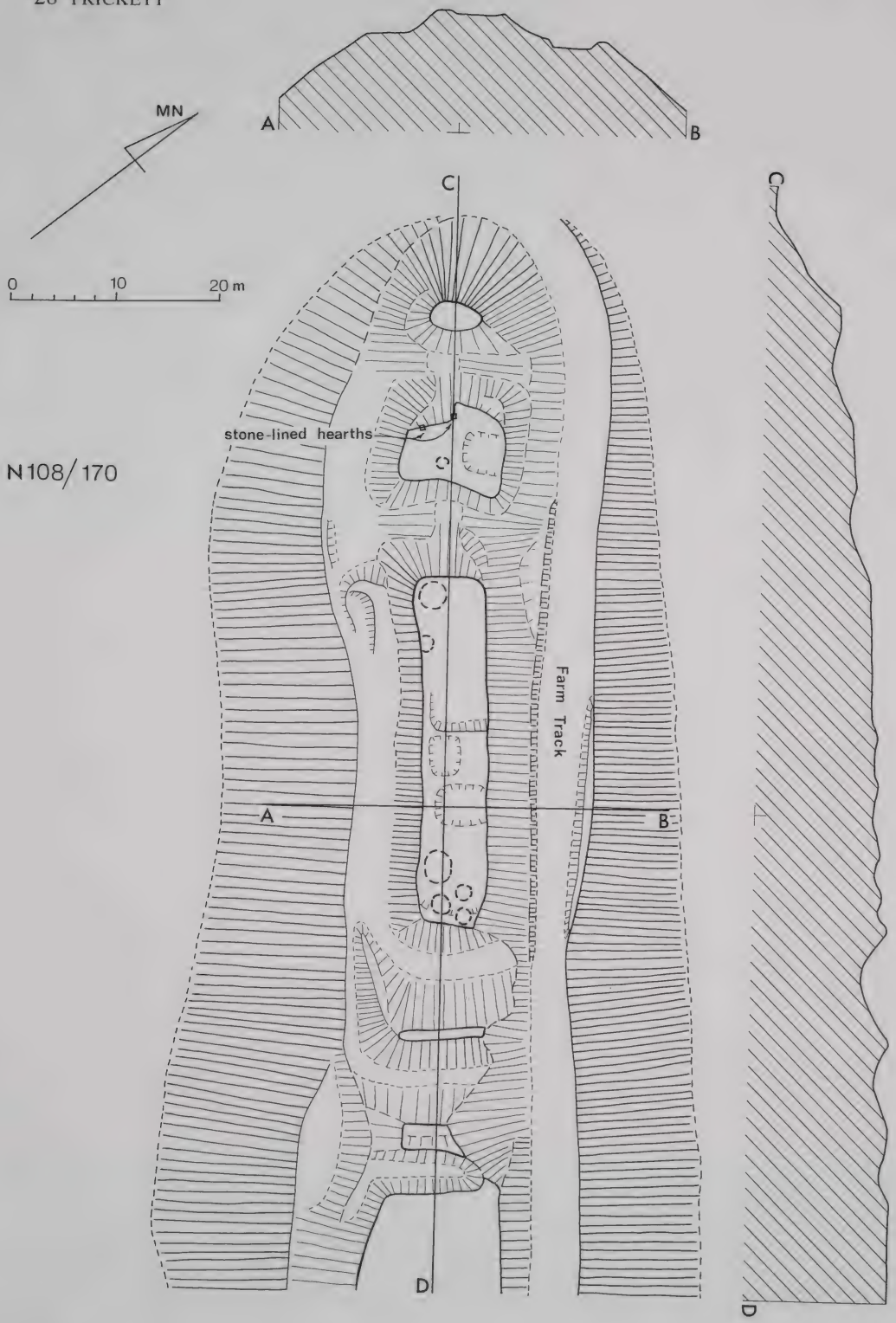


Fig. 22. Plan and sections of N108/170.

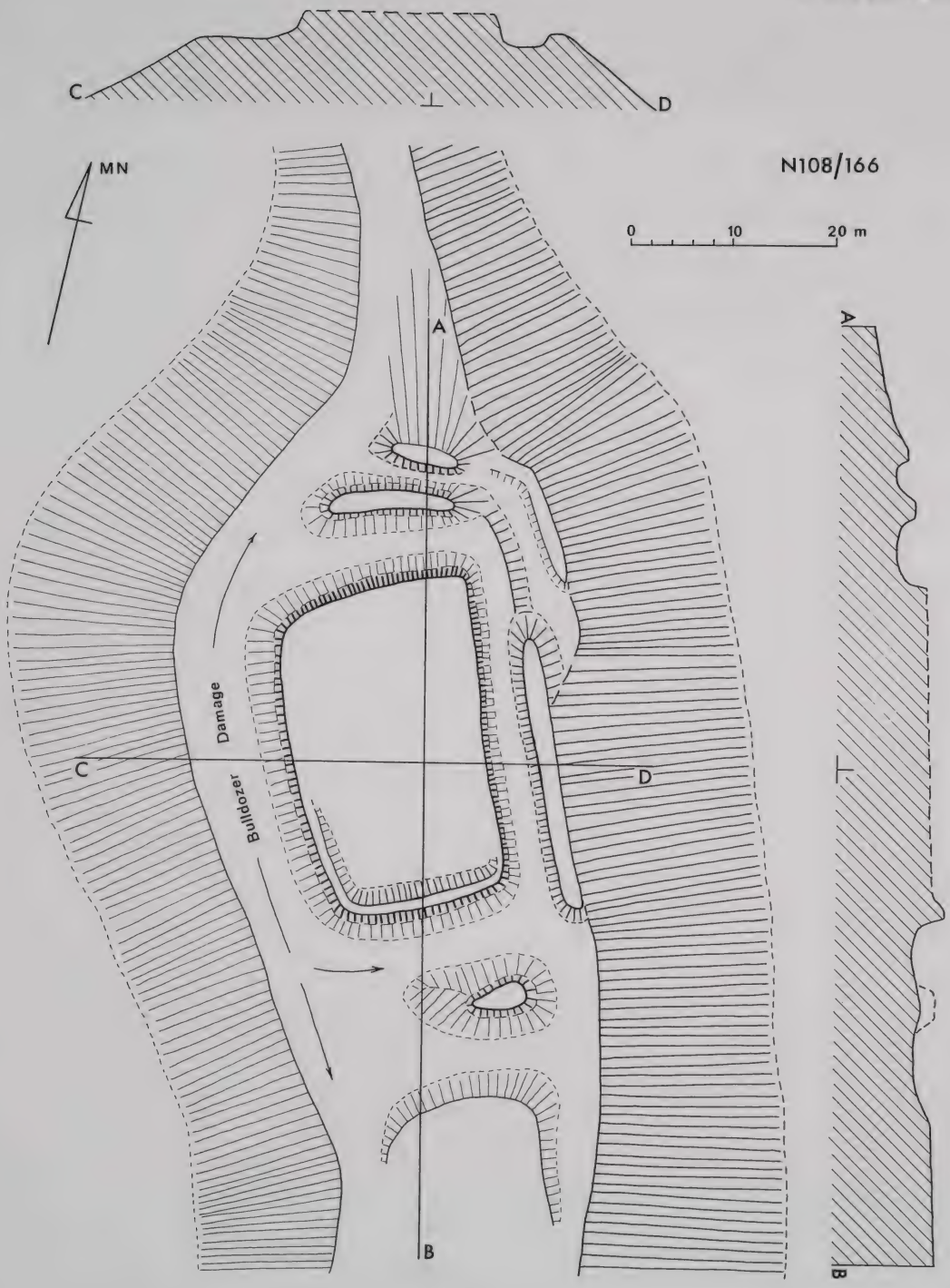


Fig. 23. Plan and sections of N108/166.

The four-sided occupation platform is 16-19 x 30 m (*ca*. 500 m²). Some *rua* are present but dense cover makes detailed mapping of this area quite impossible.

N108/167 (491817) Fig. 24

This small fortification is situated on the terrace edge above the right bank of a northerly tributary of Pitone Stream, off Greenwood Road, 1 km from the sea. The earthwork has a very indistinct outline, now under pasture and some gorse.

N108/167 occupies a slight knoll which gives a useful view over the terrace north and east. South and west is a steep 20 m scarp into the adjacent gully. Artificial defence consists of a single shallow ditch and bank which extends around the north-east side of the knoll, and a slight terrace, 4 m below the platform, which runs around the rear above the gully.

The occupation platform is *ca*. 9-12 x 18 m in size, giving an area of *ca*. 170 m². A possible *rua* survives on a slight terrace outside the ditch at the west end of the site.

N108/165 (486818) Fig. 25

This curious earthwork is situated on a prominent hill which stands at the terrace edge above the left bank of Pitone Stream *ca*. 600 m from the beach. It commands an excellent view all around. The site is now under grass, but does not appear to have suffered from cultivation.

East and south of this fortification is the steep-sided gully of Pitone Stream. West and north is terrace country some 8-10 m below the occupation platform of the site. Artificial defence consists of a single ditch which runs at a low level around the knoll on the north and west sides, and extends part-way down the steep south side. This ditch survives only as a terrace for much of its length. To the east and south-east defence is left to the precipitous natural scarp. Inside the ditch a moderate slope of 3-4 m height rises to the rim of the occupation platform.

Most of the approximately 800 m² area within the ditch is unmodified slope below the occupation platform. The platform itself is as much as 14 x 26 m, giving an area of *ca*. 330 m². There is also a small terrace outside the defences at the west end. The main platform is backed on the south side by a substantial bank almost 1 m high. Extending north from this bank are four lower banks which divide most of the platform into rectangular depressions of roughly equal size. It seems likely that the bank on the south side is protection from the weather, while the lower arms extending at right angles mark the walls of adjacent dwellings or other structures backed up against the south wall.

N108/106 (484824) Fig. 26

N108/106 is situated on a spur above the beach on the north bank of Pitone Stream. The site is now cut by the road linking the seaward ends of Pitone and Greenwood Roads which runs in a 2.5 m deep cutting through the centre of the work. The present farm race which runs along the south-east flank of the site makes use of former defences here, which are visible in the 1950 aerial photograph (1789/4). Elsewhere the site is under pasture and boxthorn hedge.

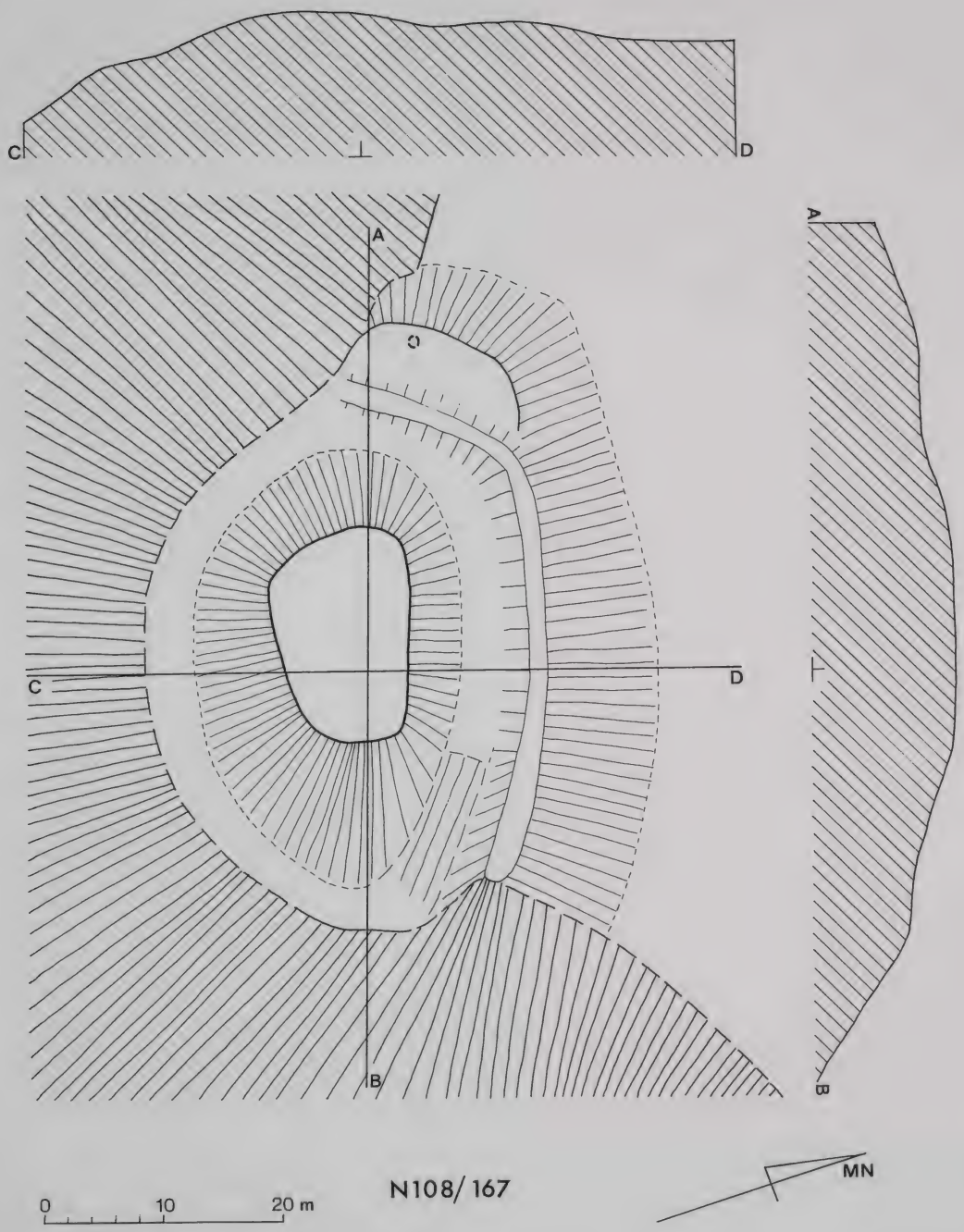


Fig. 24. Plan and sections of N108/167.

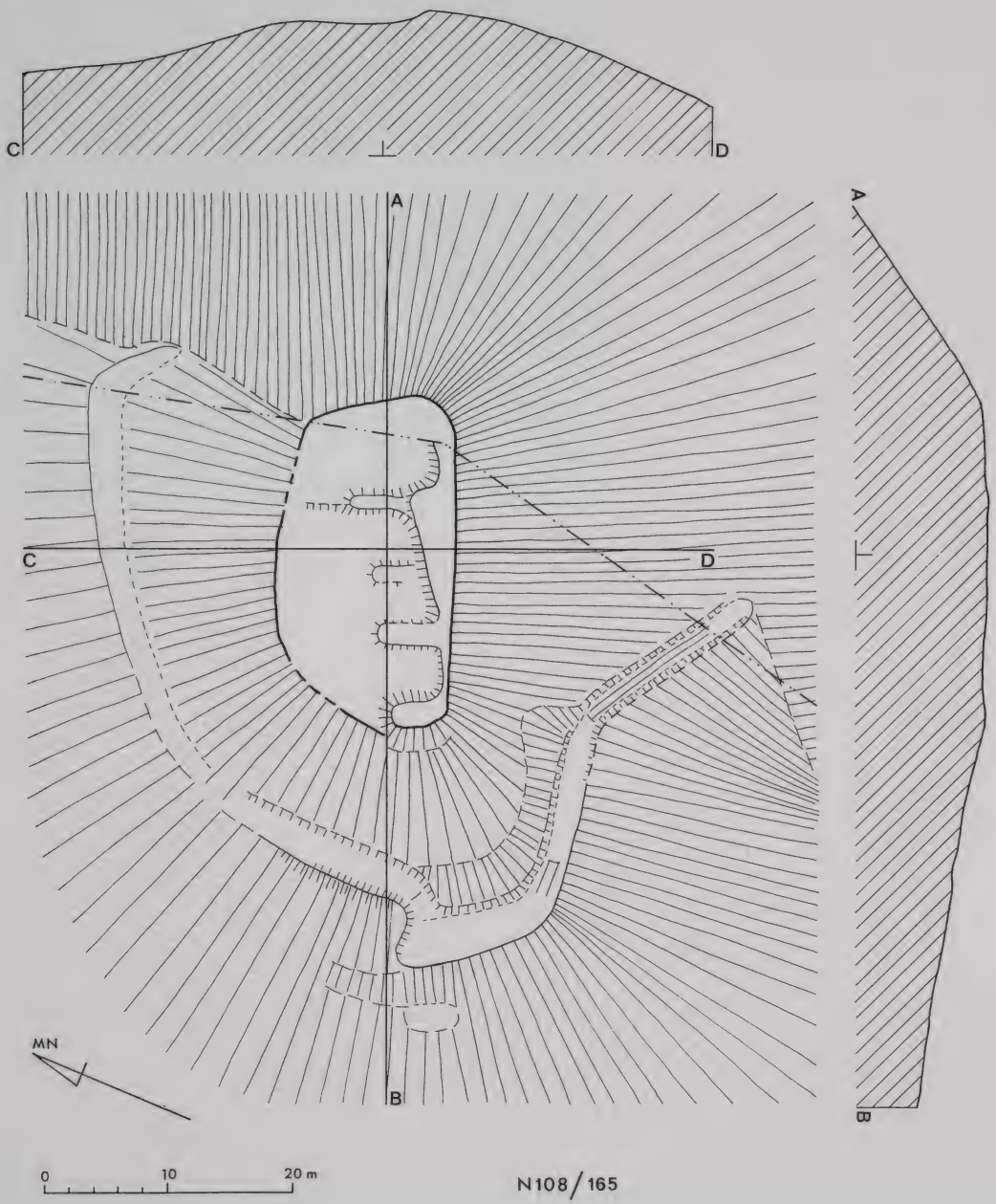


Fig. 25. Plan and sections of N108/165.

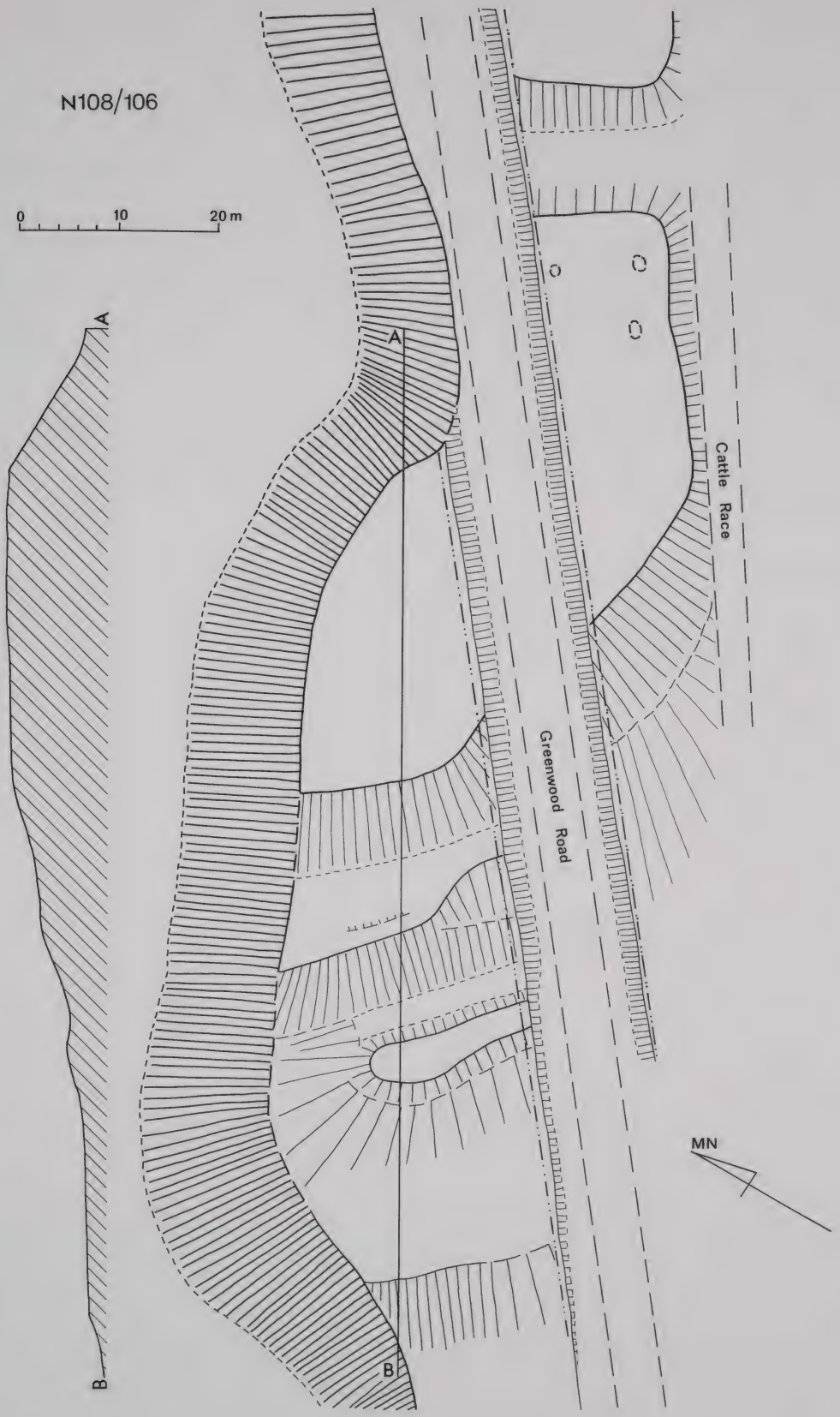


Fig. 26. Plan and section of N108/106.

The fortification takes up the western extremity of a major area of terrace country which extends as far east as the valley of Timaru River and as far south as the Upper Timaru Road across the river from Manawapo. The north is defended by a 15 m cliff to the rear of a 30-40 m wide area of low dunes behind the beach. To the south is a steep slope into the adjacent gully. Access is easy up the spur from the beach, while to the east the level terrace provides no natural obstacle. Artificial defence consists of a ditch and bank which extends from cliff to cliff around three sides of the site. An additional ditch cuts the lower spur to the west, with possible further terrace and scarp defence a further 20 m down the spur.

The level occupation platform is as much as 75 m long and averages 20 m in width, giving an area of *ca.* 1200 m^2. The broad ditch and terrace of the lower (west) end may also have provided defended living space. Three *rua* have survived at the east end of the platform.

Tataraimaka N108/100 (478823) Fig. 27

Listed by Skinner (1946:64) as one of the three major fortifications of the Tataraimaka district, the pa from which the district takes its name is located on a coastal headland 200 m east of the Katikara River mouth. The site is within an historic reserve administered by the Lands and Survey Department. Construction of Pitone Road and of the road cutting which leads to the beach south of the pa may both have involved damage to outer defences. Damage has also been done to successive terrace and scarp defences at the west side of the fortification by a path which runs to the topmost platform. Canopy vegetation is predominantly pohutukawa with some macrocarpa and karaka. Taupata and flax cling to the exposed seacliff. Recent felling of large macrocarpa trees, which formerly dominated the lower terraces, has resulted in a dense growth of poroporo, kawakawa and inkweed.

Natural defences of Tataraimaka consist of a 40 m cliff around the north and west sides, to the boulder beach and low-lying ground behind, and a steep slope to the low isthmus which cuts the pa from the extensive terrace country inland. Artificial defences are made up chiefly of a series of scarps, as much as 6-8 m high,which cut the promontory from one side to the other. The topmost of these scarps is supplemented by a ditch as is the massive bottom scarp. It seems likely the surviving ditch now adjacent to Pitone Road is the major outer defence, although what has been destroyed here by the road is somewhat problematical. Some defensive banks occur at terrace edges throughout the site. In at least two places large beach boulders have been used to revet short sections of scarp.

Tataraimaka is roughly triangular in shape with surviving defences along the broad landward side approximately 100 m long and the depth of the fortification from here to the seaward margin of the topmost terrace between 60 and 80 m. The total area of the site is *ca.* 3500 m^2. Living space, however, takes up only a small part of this. The topmost platform is *ca.* 10-16 x 18 m (*ca.* 200 m^2). A single *rua* is dug into the rear of a shelf at the seaward side. Below the platform two small terraces are cut into the steep seaward faces north and west. The next major living terrace is *ca.* 16 x 42 m in maximum dimensions (*ca.* 500 m^2). The upper part of this terrace dips to the south-east. Two depressions indicate houses. The third major living platform extends for 75 m across the full width of the site. It varies between 6 and 10 m in width and might be 600 m^2 in area, this including an extension on the steep scarp at the western flank of the site. Two *rua* survive at the

western end of this terrace. The three major living platforms thus total 1300 m^2 in area. Other minor terraces and platforms at lower levels may also have been used in part to provide accommodation.

Tataraimaka was taken by a northern *taua* (war party) which included Nga Puhi, Ngati Whatua, Ngati Toa, Ngati Tama and some Te Atiawa shortly before 1820 (Smith 1910:285-287). It is said that two muskets among the northern party were the first seen in Taranaki. The attackers used the guns to pick off defending chiefs before the pa was stormed. In April 1863 St George's Redoubt was thrown up by the 57th Regiment on the

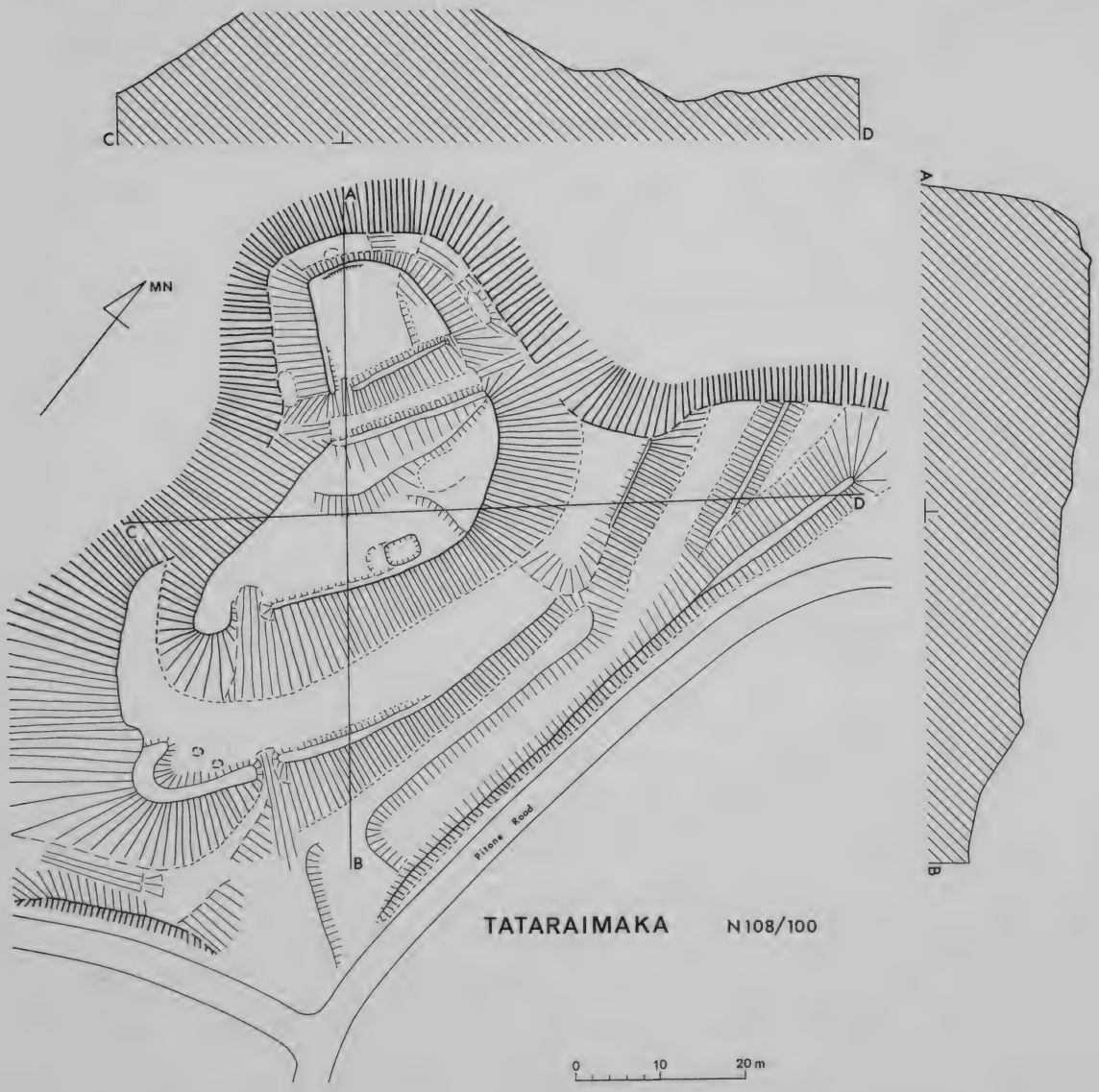


Fig. 27. Plan and sections of Tataraimaka (N108/100).

terrace edge immediately south. The top platform of the older fortification was then modified to accommodate a signal station. An earth bank was raised and it is likely, too, that the ditch outside also dates from this period. The path through the fortification in all likelihood dates from this occupation, and lower terraces may also have been modified for defence and perhaps accommodation. The soldiers called the pa 'the crow's nest'.

Pukeporoporo N108/90 (487778) Figs. 28, 29

Pukeporoporo is the third of Skinner's three major pa of the Tataraimaka district (Skinner 1946:64). The site is located above the right bank of Katikara River *ca.* 4 km from the sea, 300 m seaward of the main road. It is mostly in excellent order, although stock are causing active erosion to the steep scarp — and extensive deposits of shell midden — above the river. The preparation of farm access tracks has caused some damage to lower levels on the north-east side. The site is now under pasture with remnant native bush in the gully to the north and at the bottom of the Katikara River valley to the west.

This pa occupies a high point on an isolated, 400 m long, ridge within the Katikara River valley. It is connected to the terrace country eastwards by a natural causeway which crosses the adjacent low-lying ground at the head of a small gully. Because of the very dissected countryside about Pukeporoporo on both sides of the river, even higher levels of the site give little command over nearby ground. The pa has good natural defences on all sides. To the west is a precipitous slope which falls directly to the Katikara River 45 m below the highest point of the site. On the other side of the ridge is a gully which drains to the north and a flat-bottomed depression 50 m across which lacks natural drainage. At both ends of the ridge, especially at the south end, is a steep rise from the valley bottom.

Pukeporoporo is a very complex site occupying a total length of the ridge of almost 350 m. At the high point in the ridge is a defended position of considerable strength. Extending a further 240 m to the north-west is an extensive area of terraces, platforms, scarps and *rua* which make up a unique instance in the survey area of a significant undefended occupation area outside a pa having survived the past 100 years of European agriculture virtually intact. Several transverse scarps in this area offer potential for defence. The total area taken up by this undefended living area may be estimated at 6000 m^2.

The fortified position, or citadel, of Pukeporoporo occupies an area of *ca.* 40 x 100 m at the south-east end of the ridge. Surface evidence is now difficult but it is likely the form of defence was basically that of a discontinuous ring-ditch almost completely enclosing the hill-top. This ditch is very clear at the north-west end but less so at the south-east end and the sides where it now has the form of a terrace. A steep defensive scarp runs right around the fortification outside the bank or terrace edge. At the south-east end a short terrace (probably originally a ditch) cuts the spur at the top of its steep rise from the nearby gully. At the north-west end three terraces and scarps outside the outer bank offer some potential here for additional defence. On the narrow causeway to the north-east, recently prepared farm access has cut the end of a ditch which survives in part on one side of the causeway — and which can just be made out in the 1950 aerial photograph (1790/6).

The defended area of Pukeporoporo citadel is difficult to establish because of the indistinct remaining earthworks. An area of *ca.* 2000 m^2 may, however, be a reasonable estimate. Within this defended area the blurred remains of terraces, which in general dip to the south-east, offer none of the clear-cut surface features present on other sites. Indeed

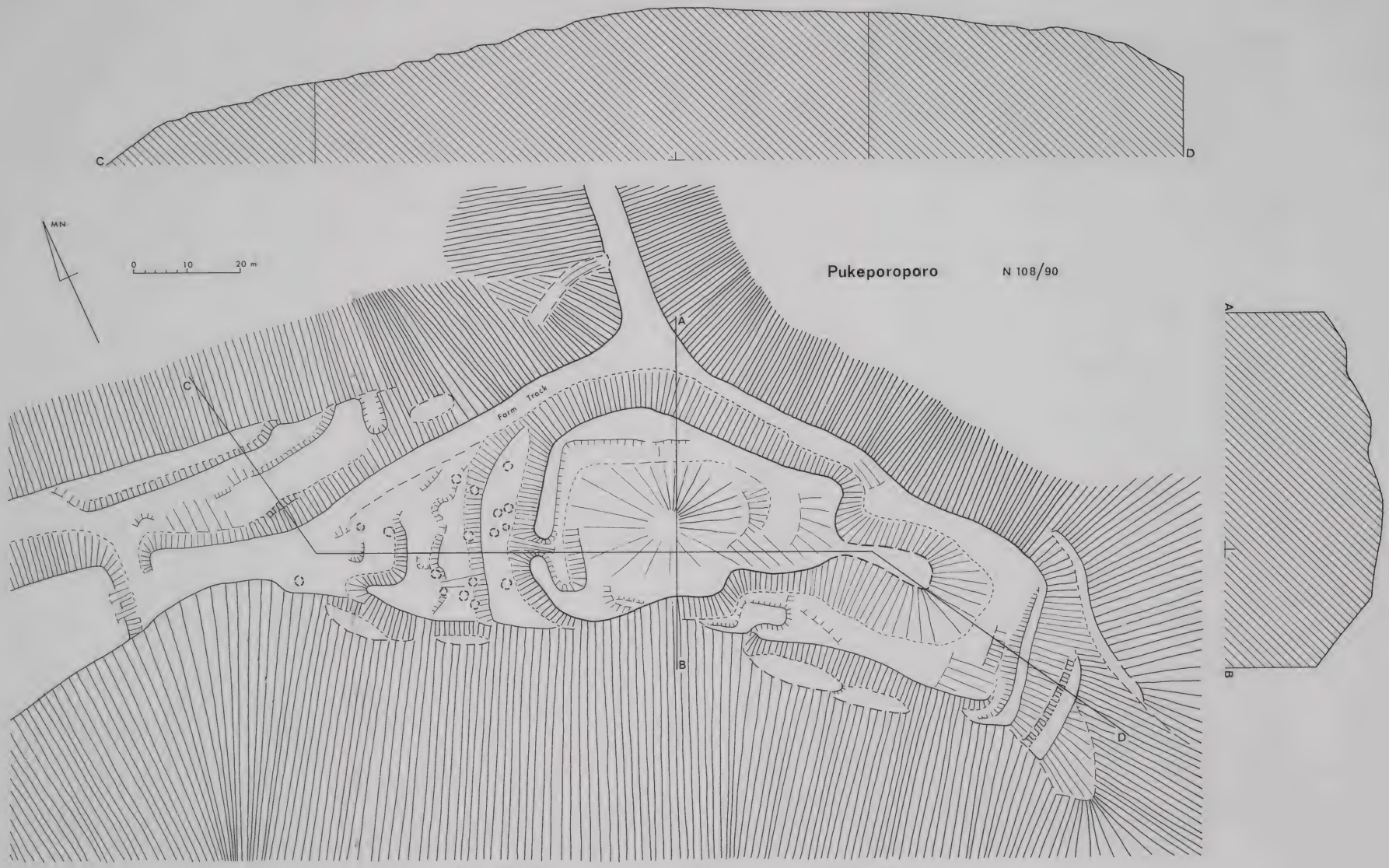


Fig. 28. Plan and sections of Pukeporoporo (N108/90).

Fig. 29. Pukeporoporo — aerial view from the north-east (1975).

the highly enigmatic area within the hill-top defences may be contrasted with occupation areas immediately outside which have surface features of typical form. Two terraces survive on the steep hill slope to Katikara River. Outside the north-west end of the citadel is a series of terraces which are occupied by a total of 17 *rua*. Below these are some massive living terraces above the gully to the north.

N108/179 (485783) Fig. 30

Approximately 200 m west of Lower Pitone Road, N108/179 is south-west of Pukewaranga and north-west of Pukeporoporo, close to the right bank of the Katikara River. It is situated inconspicuously on a small spur 5-10 m lower than the general level of the surrounding terrace country. To the east it is overlooked from the terrace rim, 40 m away; it does, however, overlook a wide area of more distant country across the Katikara River to the south and west. N108/179 is now under pasture with remnant native bush, predominantly karaka and kawakawa, in gullies on three sides. In the 1950 aerial photograph (1790/6) the earthworks are obscured by an irregular plantation of macrocarpa and pine trees. These trees have since been removed resulting in the almost complete destruction of the site.

The pa is bounded north and south by small and steeply rising gullies which curve sharply to meet in front of the site before running out to the Katikara River. Useful natural defence is provided on three sides by precipitous 15-20 m slopes into these adjacent gullies. At the remaining end a transverse ditch cuts the spur at a comparatively low and

Fig. 30. Reconstruction of defences of N108/179.

narrow point. Outside the ditch the ground rises steadily to the terrace rim some 35-40 m away, from which defences and occupation area are completely overlooked. Damage done to this pa makes interpretation of the defences far from easy. The 15 m long transverse ditch is clear from a surviving 4.5 m length which indicates both massive ditch and high bank on the inner rim. The counter-scarp is 1.8 m high, the ditch 5 m across, and the main scarp 2.5 m to the top of the inner bank. A causeway across the surviving north end of the ditch appears to be an original feature. Behind the transverse ditch there appears to have been a ring-ditch enclosing the occupation platform. This is indicated by a remaining rim of the outer bank along the west end of the site (which also makes a difficult appearance along the south side), and by slumped ground suggestive of fill which lies within the natural margin above the gullies.

Material for filling the encircling ditch has been taken from the former occupation platform, which is now a featureless mound. The size of the destroyed platform can be roughly determined from the margin of fill which in places has slumped into the former ring-ditch. A platform *ca.* 12-18 x 18 m is indicated, providing living space of approximately 270 m^2.

Puketotara N108/176 (479786) Fig. 31

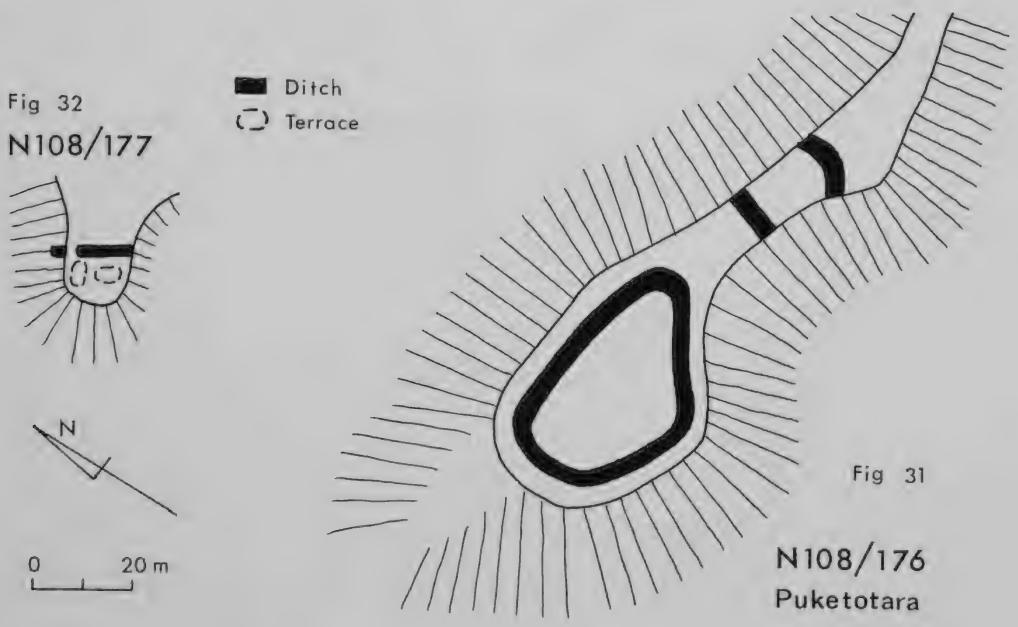
Puketotara is situated on the right bank of Katikara River *ca.* 3 km from the sea. It occupies the broad and dominating end of a spur which extends west and then north-west from the terrace country of Lower Pitone Road. The site commands a wide view of the Katikara River valley, west across the river, and east up rising ground to Pukewaranga. Only to the north does the rim of higher ground 100 m away allow command of no more than the adjacent gully. Pukewaranga and Pukeporoporo are both visible from Puketotara, with the first named dominating the easiest approach down the spur from the south-east. The site itself is now under pasture with remnant native bush including karaka, mapou, kohekohe, kawakawa, mahoe, mamaku and titoki surviving in gullies north and south and in the valley of the Katikara River to the west. In the 1950 aerial photograph (1790/6) the earthworks are invisible under bush. About 1965 the bush was cleared off the pa and the earthworks almost completely destroyed during accompanying bulldozer work.

Natural defences of Puketotara are provided to the west by a steep 40 m slope to Katikara River, to the north and south by precipitous 10-12 m drops into adjacent gullies, and the east by a low and narrow spur. Higher ground is *ca.* 200 m from the defended area along the spur. Remaining archaeological evidence, along with information from the present land-owner, indicates that the pa was defended by an encircling ditch and bank which enclosed an area perhaps less than half that available above the precipitous slopes into adjacent gullies. At the south-east end of the site the approach down the spur is barred by a massive ditch, still largely intact, which is perhaps 40 m from the former platform rim. A second transverse ditch behind this is now destroyed. Thus the pa was probably defended by an encircling ditch and bank with two transverse ditches at the vulnerable up-spur end. There is some difficult archaeological evidence for two more possible transverse ditches, *ca.* 50 m forward of the surviving ditch, at a point where the spur drops slightly before continuing to the dominating terrace country nearby.

Little can be said concerning the occupation platform of this pa. It could have been of a roughly five-sided plan with greatest width perhaps 24 m and greatest length of not more than 40 m. A defended area of 700-800 m^2 is indicated. Some of the shallow pits may indicate collapsed *rua*.

N108/177 (481786) Fig. 32

Two hundred metres east of Puketotara a ditch cuts off a tiny blunt spur from rising terrace country beyond. The work is overlooked from higher ground 80-120 m north and east, but does overlook the spur to the west which leads down to Puketotara. The site is now under pasture with some damage to the south side resulting from recent quarrying for soil.



Figs. 31, 32. Reconstruction of pa defences. 31. Puketotara (N108/176). 32. N108/177.

Natural defences of N108/177 are poor. To the north is a steep 15 m drop into a gully, while to the south is a steeply rising tributary gully which is only 4 m deep adjacent to the site. From the fork of these two gullies is a steep slope up to the defended area. Across the ditch the ground rises steadily to the terrace edge. Artificial defence consists only of a 10 m length of ditch which cuts the spur. The ditch is in unusually good condition, 1 m across at the base, with a counterscarp *ca.* 2 m high and a main scarp to a massive but badly formed bank on the platform rim *ca.* 3 m above the ditch floor. A slight causeway at the north end of the ditch indicates access into the defended area. Beyond this a shallow extension to the ditch of 3-4 m quickly disappears down a steep slope into the gully.

The causeway across the ditch runs on to an ill-formed terrace. This terrace begins next to the defensive bank and extends *ca.* 8 m along the northern margin of the defended area next to the rim above the gully to the north. Another difficult terrace is located immediately behind the defensive bank. With the exception of these terraces the defended area slopes away without apparent modification before sharply dropping away to the gully fork from some 10 m behind the rim of the defensive bank. The defended area can be little more than 80 m^2. The site should probably be viewed in conjunction with Puketotara: it commands the easiest approach to the larger pa and can hardly have been defended on its own.

Pouteau N108/27 (472801) Figs. 33, 34

Pouteau is situated on the right bank of the Katikara River 1.7 km from the sea. It is low on an undistinguished spur which extends north-west between the river and a small neighbouring gully. Pouteau is one of the largest, and the furthest upstream, of a group of eight fortifications which extend along both banks of the Katikara River upwards of 1 km from the sea. Also on the right bank are N108/102, 103, 161 and 162, while across the river are N108/101, 104 and 160. Together these sites make up the most concentrated group of pa examined in the present programme. Pouteau can be seen in the 1950 aerial photograph (1790/6) under gorse and pasture. It is now under pasture with gorse and remnant native bush including karaka, mahoe and kawakawa surviving on the adjacent cliff to the river. Considerable damage has been done to the site since 1950: down the northern side where the ditch and bank forms the basis of the present farm track, and through the centre where successive ditch and bank defences have been cut to provide a second route down the spur.

Pouteau is well protected on the south-west side by a 15-20 m cliff to the Katikara River. On the opposite side is a steep slope of 8-10 m into a narrow and swampy gully. At the south-east end of the site a very slight dip offers no natural advantage over an advance down the spur. The pa is dominated both from higher up the spur and from the higher ridge to the north-east only 60-80 m distant (on which N108/102 and 103 are situated). The lower end slopes away to an extensive river flat, *ca.* 60 m from the defences and 10 m below. Artificial defence is chiefly made up of a single ditch and bank which extends around the site except where the cliff of the south-west side intervenes. Two further transverse ditches cut the occupied area into three sections. These interior ditches are quite as large as the chief transverse ditches at the ends of the site, and like them are supplemented by massive banks on the platform rims. The nature and scale of the interior defences makes Pouteau an unusual site for the region.

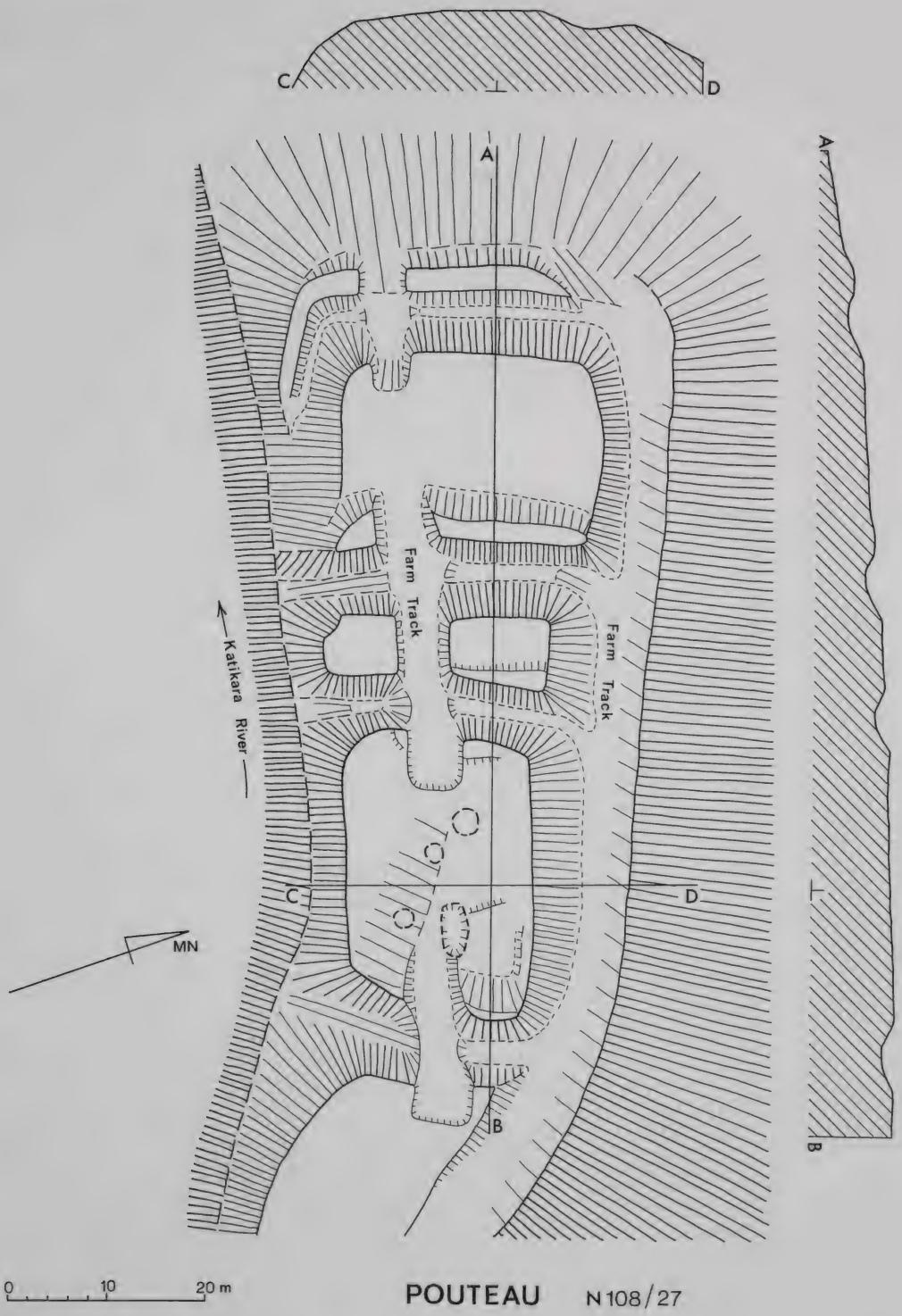


Fig. 33. Plan and sections of Pouteau (N108/27).

The total area defended by the external defences of Pouteau is 18-26 x 66 m, *ca.* 1400 m^2. If the interior defences are excluded, however, the three occupation platforms are *ca.* 460 m^2, 140 m^2 and 425 m^2 respectively, giving a total defended area of 1025 m^2 available for occupation. Only the uppermost platform contains evidence for internal organisation: some slight scarps suggest preparation for houses or similar structures, while two or three *rua* are indicated by the characteristic circular dimples. A large and deep pit may represent two adjacent *rua* which have had their roofs collapse.

N108/102 (472805) Figs. 34, 35

N108/102 is located on a long spur which extends north from the terrace country of Lower Pitone Road to the right bank of Katikara River. It is situated at the point where the spur narrows to 30-40 m width, and is 120 m south of N108/103 which stands above the river. The present landowner reports that when the area between the two fortifications was first ploughed by his father the horses kept dropping into holes: these were clearly *rua*, and indicate that this intervening area provided occupation space additional to the defended areas of the two pa. The defences of N108/102 are now under pasture, with the platform and its scarps under scattered native trees including karaka, mahoe and wharangi. Some damage has been done in the past by the preparation of farm access down the spur which makes use of the ditch and bank of the east side of the site, and cuts the transverse defences of both ends. Severe damage is now being done by stock 'camping' under the trees on the top platform and breaking down the scarps, especially of the east and north sides.

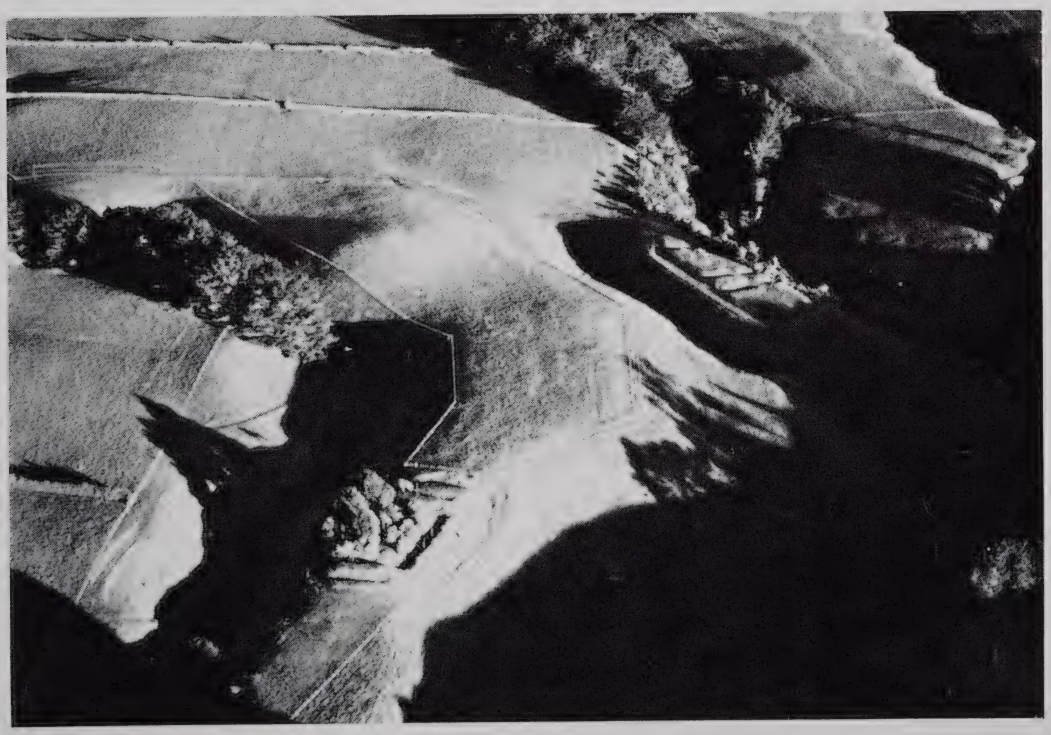


Fig. 34. Pouteau (upper right) and N108/102 — aerial view from the north-west (1975). N108/103 is in the shadow front left.

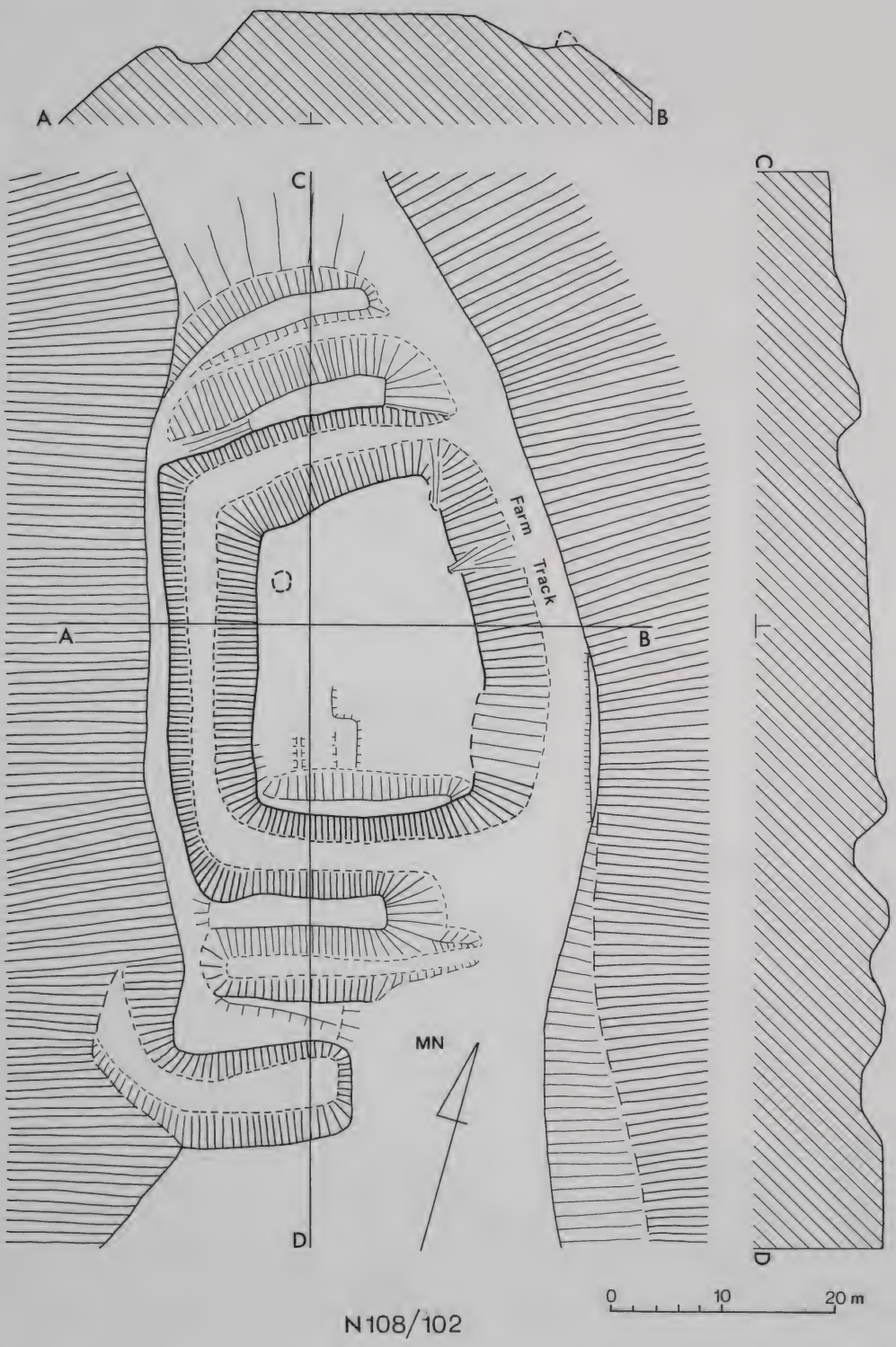


Fig. 35. Plan and sections of N108/102.

The fortification has good natural defence at both sides with precipitous 12-15 m slopes into a steep gully to the east and to a broad river bank flat to the west. To the north the spur falls away 6-8 m to N108/103, while up the spur to the south the site possesses a 1-2 m height advantage over perhaps 50 m before higher ground is reached. Artificial defences consist of a ring-ditch, with two additional transverse ditches at the more vulnerable south end and one more at the north end. At the south end the two outer ditches do not appear to have cut the spur, although present surface evidence may mislead on this following modification for farm access. The platform scarp is 2-4 m in height. Elsewhere defensive scarps and counterscarps are 1-3 m. A bank at the up-spur (south) end of the platform rim stands 1 m above the interior.

The roughly four-sided occupation platform has an area of *ca*. 500 m^2. Slight terraces and banks at the higher, southern, end show some preparation of living platforms. One *rua* is suggested by a dimple near the north-west angle.

N108/103 (472806) Fig. 36

This small pa is located on the right bank of the Katikara River 1.2 km from the sea. It is 120 m north and on the same spur as N108/102, and is immediately over the river from N108/104, a fortification very similar in scale and design. N108/103 is close to the northern end of a long spur which runs off the terrace country of Lower Pitone Road. From its south-east side the defences fall away into a gully which extends south-east almost as far as the road. The site shows up well under light scrub in the 1950 aerial photograph (1790/6). It is now under mature pine trees with some pasture at the south end. Large pine trees have badly broken up and obscured features on the occupation platform, while the scarps are suffering from severe stock damage in places.

Natural defences consist of a precipitous 20 m scarp to the Katikara River on the north-east side and a similarly steep drop of *ca*. 15 m into the adjacent gully to the south-east. The south presents an easy approach down the spur from N108/102, although, of course, if the neighbouring site was occupied at the same time, clearly this quarter would be well protected. To the south-west the terrace edge 20 m from the defences obscures any approach from this direction, although, again, lower ground beyond the rim is well covered from the neighbouring pa. N108/103 has good command to the north-west over the low bend of the river — ground which in this case is obscured from N108/102. With indications that the intervening ground was occupied by settlement, a good argument can be made that these two fortifications provided complementary defence from positions which between them commanded nearby ground in all directions. Artificial defence of N108/103 consists of a single encircling ditch with platform scarps as much as 3.5 m high. There is a slight bank on the platform rim at the south-east and south-west margins.

The occupation platform is 10-15 x 16 m, or *ca*. 200 m^2. Three depressions include two which are rectangular and suggestive of houses. Surface evidence indicates two *rua*.

N108/161 (474807) Fig. 37

N108/161 is located on the right bank of the Katikara River 1 km from the sea. It is situated on a spur which drops away to the north between the river and a short gully which rises rapidly to the terrace country of Lower Pitone Road. Across this gully is the neighbouring fortification, N108/162. N108/161 is now under grass and scattered gorse, with mature pine trees down one side above the cliff to the river. In the 1950 aerial

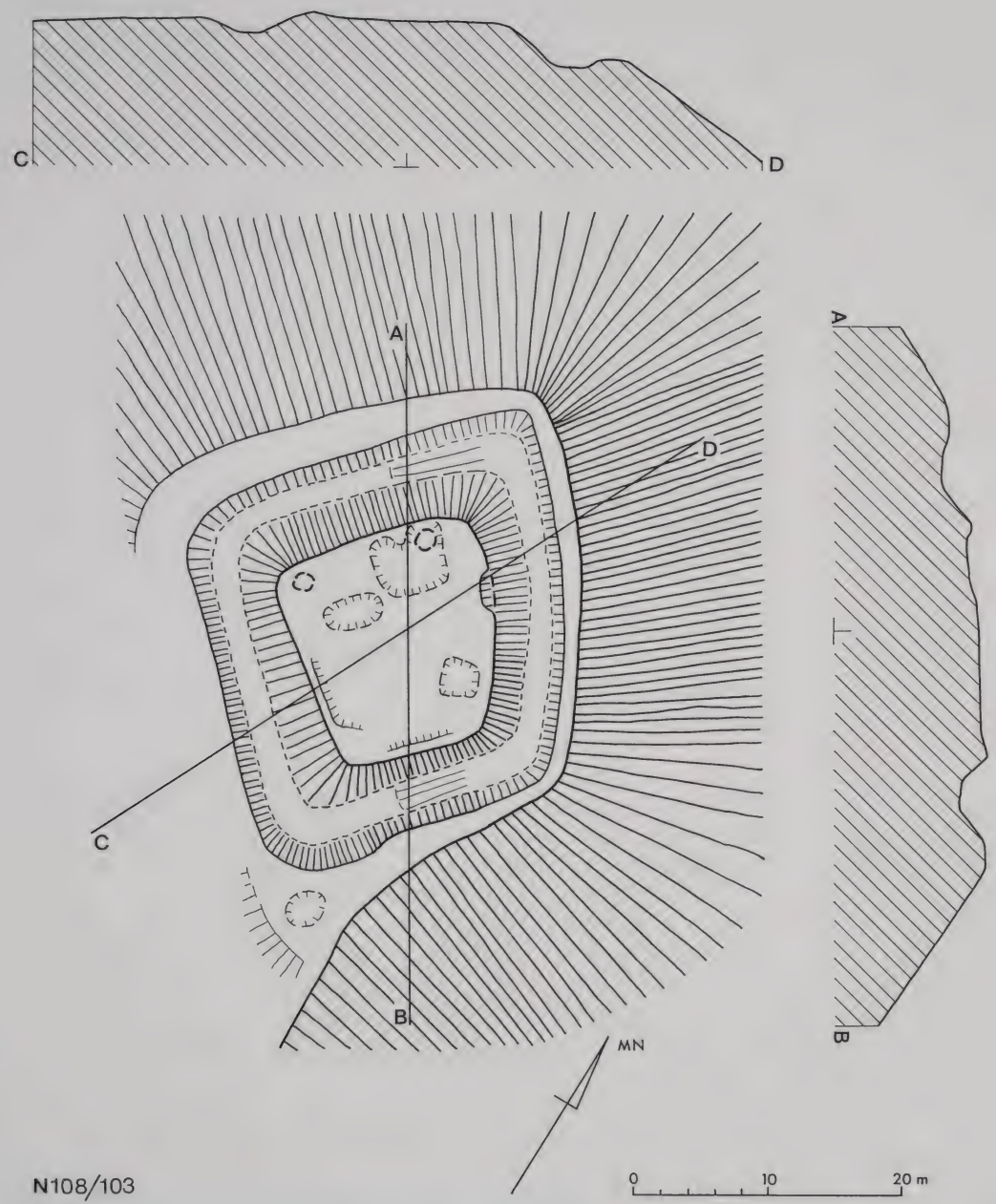


Fig. 36. Plan and sections of N108/103.

photograph (1789/2) the site is invisible under trees. The plantation was felled and removed in the late 1950s and the site itself was devastated at the time. The upper and lower transverse defences and the occupation platform have suffered greatly; only the ditch and bank defences of the east side remain in good order.

Natural defences consist of a 20 m cliff to the river on the west side and a steep 6-10 m slope into the gully to the east. At the lower, north, end of the pa artificial defences cut the spur at a low point, beyond which the spur rises slightly to continue for a further 20 m before dropping sharply to the river. At the upper end of the site the rapidly broadening spur extends on to the general level of the terrace country *ca*. 60 m outside the defences. Like so many pa of the region, N108/161 is completely dominated from the nearby terrace edge. At this end of the fortification, archaeological evidence at the cliff edge (where it has been protected by the fence and the steep face above the river) is for a single transverse ditch. Evidence at the other side of the site (above the gully) is less clear. A local informant says there were three transverse ditches at this vulnerable quarter, and, indeed, more than one would be expected. Other artificial defence consists of a single lateral ditch and bank on the east flank, and two ditches cutting the now narrow spur at the lower end. Defence on the west side was left to the cliff to the river.

The occupation platform is *ca*. 11-18 x 40 m in size, giving an area of *ca*. 600 m^2. It dips *ca*. 6 m from south to north, but despite this, lacks any evidence for terraces or other internal features. Whether these were present cannot now be determined.

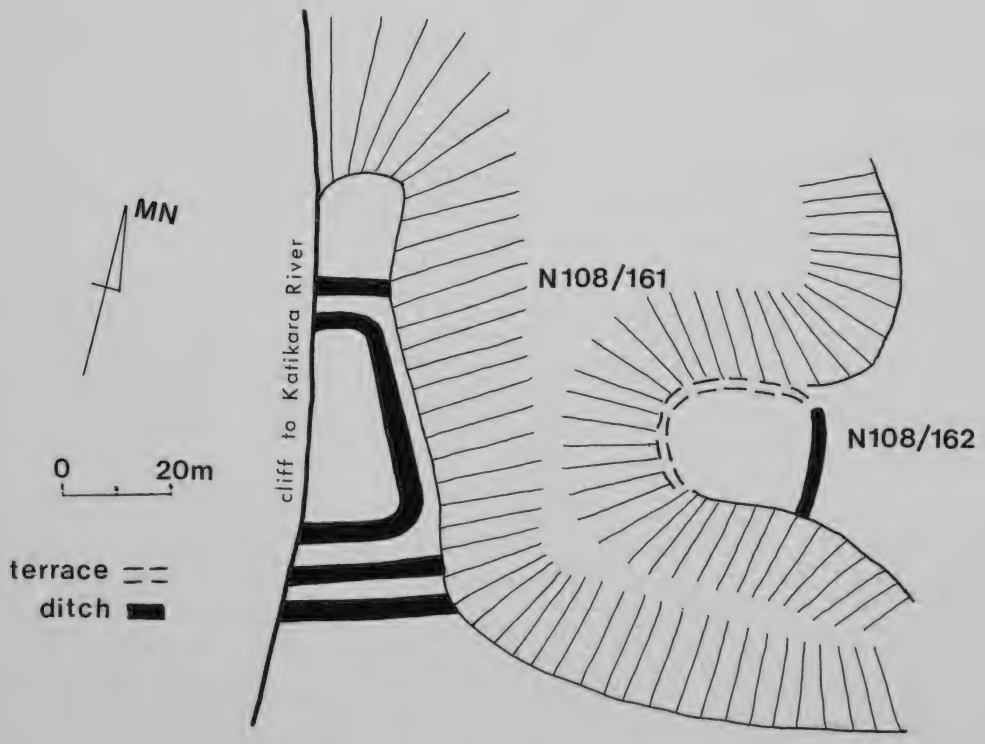


Fig. 37. Reconstruction of defences of N108/161 and N108/162.

N108/162 (475807) Fig. 37

N108/162 is situated on an abrupt little spur which drops north-west off the extensive terrace country of Lower Pitone Road. It is close to the right bank of the Katikara River, a little more than 1 km from the sea, and is immediately across the gully from N108/161. The site can be seen on the 1950 aerial photograph (1790/6). What remains is barely visible under grass.

Natural defences consist of a steep slope *ca*. 12 m into a narrow gully to the south and west, with an easier approach from the smaller gully head to the north. Access is easy from the south-east, where the relatively broad spur slopes gradually down from the nearby terrace edge, 3-4 m higher than the site and 30 m from the defences. Artificial defences consist only of a now shallow ditch 20 m long and 2-3 m wide which cuts a marginally lower part of the spur and curves slightly around the defended area at the more vulnerable north-east flank before disappearing. Approximately 5-6 m below the general level of the occupation platform is a slight terrace which runs around the front of the spur and, to an extent at least, the sides as well. This may also be interpreted as defensive.

The defended area is *ca*. 10-15 x 22 m in size, giving an area of *ca*. 250 m^2. The interior rises *ca*. 1 m above the defensive ditch. There is no sign now of any platforms or other features within the defended area.

The fortification does have a useful view of country across the Katikara River, but on the adjacent right bank fails to command any ground except the slightly lower approaches and interior of N108/161 over the gully to the west. From its location and its apparently minimal defences, therefore, it seems likely this site was supplementary to the more substantial work nearby.

DISCUSSION

As in the report on Maori fortifications of the Omata and Oakura districts, it is not intended here to present a full analysis of sites introduced in this paper. Some characteristics of the Tataraimaka sites, however, may be noted.

The present sample neatly parallels that of the Omata and Oakura districts in that 32 fortifications are recorded, eighteen of which have a ring-ditch form of defence. Five sites make use of a cliff on one side with the other three sides being defended by a continuous ditch. Another five pa have transverse ditch and bank defence aided by terraces and scarps where necessary. Other sites make a minimal use of defensive ditches and banks with a strong reliance on the natural defensible aspects of the site.

Ring-ditch pa commonly take the form of a single occupation platform defended by a strong ditch and bank, often with additional transverse defence at one or both ends. Seven are simple ring-ditch works without extra transverse defence. Pukewaranga (Figs. 14, 15), N108/98 (Figs. 6, 7) and N108/103 (Fig. 36), and probably Pukeporoporo (Figs. 28, 29), provide examples of this form. The majority of ring-ditch pa, however, have additional transverse ditches at one or both ends. Three destroyed, or substantially destroyed, pa appear to have had one additional ditch at one end (N108/120, Fig. 17; N108/173; N108/179, Fig. 30). N108/64 (Fig. 16) has two additional ditches at the vulnerable end, as also Puketotara may have done (Fig. 31). Sites with one additional transverse ditch at both ends are N108/166 (Fig. 23) and possibly N108/168 (Fig. 18). N108/102 (Figs. 34, 35)

and N108/170 (Fig. 22) have one additional ditch at one end and two at the other. Examples of unique forms of ring-ditch defence in Tataraimaka are the very complex Manawapo (Figs. 2, 3, 4) with its multiple defended platforms, and N108/99 (Figs. 19, 20) which is almost completely enclosed by a double ditch and bank.

Five pa occupy cliff-top situations which allow a modification to the usual ring-ditch form. At Pouteau (Figs. 33, 34), N108/106 (Fig. 26), N108/161 (Fig. 37) and N108/172 (Figs. 12, 13) a ditch and bank extends from cliff to cliff around three sides of the site. At three of the sites there is additional transverse defence at one or both ends, while at Pouteau, two transverse ditches divide the defended area into three separate platforms. N108/119 (Figs. 8, 9) is a more complex work where the curiously angled outer ditch is probably a later addition to the more usual inner defensive work. Other sites which make use of a cliff or precipitous natural slope at one or more sides are the unusual N108/165 (Fig. 25), the tiny N108/171 (Figs. 10, 11), and Patuha which relies almost entirely on its precipitous situation for defence.

Sites defended by a variety of transverse ditches with terraces and scarps along the flanks or at the down-slope end include the very large N108/60 and the three very small sites of N108/162 (Fig. 37), N108/167 (Fig. 24) and N108/177 (Fig. 32). The headland pa Tataraimaka appears to have been partly or wholly cut off from the mainland by a ditch, which was supplemented within the fortification by a series of massive defensive scarps. The sea-cliff provides sufficient security on the other sides.

Pa of the Tataraimaka district are in general larger than those of the Omata and Oakura districts. As an example, the ten smallest ring-ditch pa of the present survey area have an average occupation platform of 320 m^2 a opposed to 230 m^2 for the same group in the other districts (Prickett 1980:47). There are some very small fortifications, such as N108/171 and N108/177 which defend only 90 m^2 and 80 m^2 respectively, but more common are larger sites, of which ten (eleven if Patuha is included) defend a living space of more than 1000 m^2. The largest defended areas are those of Manawapo (*ca.* 6000 m^2), Tataraimaka (3500 m^2) and N108/60 at the Timaru River mouth (6000 m^2).

Within fortifications occupation platforms sometimes have considerable evidence of internal organisation. Among the more complex living areas are Pukewaranga (Fig. 14) and N108/64 (Fig. 16), each with platforms and terraces for surface structures and three different pit forms. At Pukeporoporo *rua* are clustered together on terraces immediately outside the fortified hill-top (Fig. 28). This concentration of the storage aspect of sites, however, is uncommon: Manawapo (Fig. 2) with its many *rua* scattered throughout the site, is indicative of the more usual domestic arrangement — where surface evidence allows this to be established. Manawapo also provides the best instance of a complex site where the defended area is divided into several separately defensible platforms. Smaller examples are Pouteau (Fig. 33) and N108/119 (Fig. 8) which have three and two independently defended occupation platforms respectively.

The location and situation of pa of the Tataraimaka district vary greatly. More than half occupy elevated situations from which occupants would have a useful view over nearby gullies and terrace country. Others are situated on spurs within river and stream valleys, although even here they are generally more strongly sited than the inconspicuously situated fortifications of the districts to the north (Prickett 1980:47). The largest pa

are always strongly sited, so that the location of Koru in the Oakura River valley, while not extraordinary in the context of sites of the Oakura district, is probably unusual in the wider sample.

The distribution of large and small fortifications has some interesting features as Fig. 38 clearly shows. Works with large defended areas can be seen to lie along the coast and inland at what was the forest edge at the time of first European penetration into the district. Other large pa are located high on the Kaitake Range, while several pa of lesser size can be seen to have been sited within the valleys of the Katikara and Timaru Rivers. Within the area bounded by the large fortifications are located all of the many small works of the Tataraimaka district. This pattern of large pa at the peripheries is also apparent in the Oakura district where Koru and Kekeorangi bound an area occupied by as many as fifteen small fortifications (see Prickett 1980:3). Only in the northerly Omata district does the pattern break down. Here major coastal and forest edge sites are absent, with small works clustering in the valley of the Waireka Stream south-west of the important Te Ngahoro.

The explanation for the distribution of large and small fortifications in the Tataraimaka district must surely rest upon a complementary relation between the two. While it cannot be realistic to assume contemporaneous occupation of all pa in the district, yet it is clear that any occupants of the small works may well have had links with larger fortifications to allow a rapid congregation of population for defence if necessary. Just such a strategy was adopted in the first decades of last century when a northern *taua* was defeated by a combined Nga Mahanga force at Ngaweka, at the forest edge on the south bank of Stoney River. Smith (1910:312) writes:

> ''On first hearing of the approach of a hostile force, the Nga-Mahanga *hapu*, of Taranaki, all assembled to consider what steps should be taken to meet it. Some proposed that each *hapu* should remain in its own *pa* and await attack, but one of the chiefs of Nga-weka arose and said, ''*Kia kotahi ano taringa hei ngaunga ma te hoa riri.*'' (''Let there be only one ear for the enemy to bite'')''.

In addition to their strategic relation to small fortifications the siting of large pa at the coastal and forest margins also gives those fortifications a tactical advantage in the event of siege. The tactic of abandoning fortifications which were under severe pressure is one that was adopted many times in Taranaki during the campaigns of the 1860s against the Pakeha: the location of fortifications on the coast (assuming canoes were available) and at the forest fringe may well indicate a similar motive for siting the earlier pa. Coastal pa also commanded the commonly used route through the district which lay along the beach.

The many smaller fortifications of the Tataraimaka district indicate an independent and fragmented society — this at least in normal times when external threats were absent. These works could hold little more than thirty or forty people at most if allowance is made for storage, cooking and other facilities in addition to dwellings. The few recorded undefended sites, or *kainga*, in this part of the Taranaki coast leads to the suggestion that these small pa in effect take their place in the settlement pattern, and may therefore be regarded as fortified homesteads. They were probably located close to gardens and are never more than an easy day's walk from the sea-shore and forest where food and other resources would have been available. Their frequent location low within stream or river valleys may be partly explained by their role within a network of similar works which

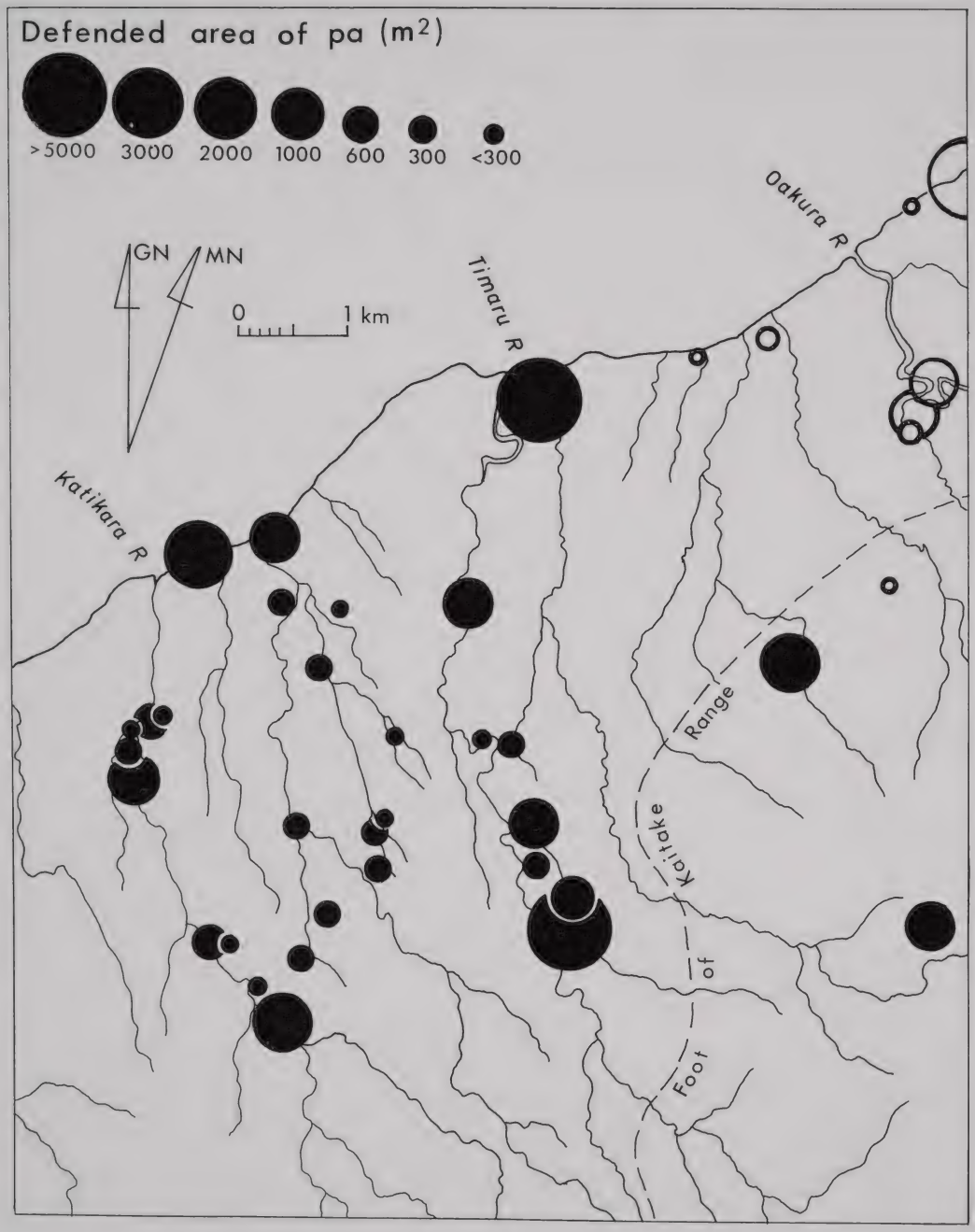


Fig. 38. Distribution and defended areas of pa in the Tataraimaka district. Open circles indicate sites recorded in the Oakura district (see Prickett 1980). Sites on the west bank of Katikara River are not shown.

might prevent any surprise or tactical disadvantage at the hands of a hostile external force. That they performed a role in feuding within the larger tribal structure also seems likely; thus they allowed both local independence for *whanau* or *hapu* groups, and the security of combination against more powerful external forces, within a network of small works and their related tribal citadels.

One other aspect of the distribution of pa as shown on Fig. 38 that bears some comment is the comparative lack of fortifications within the narrow waist of land between the rugged Kaitake Range and the sea. North and south of this area numerous works are scattered over the landscape: between the major valleys of the Oakura and Timaru Rivers, however, there are only a handful of pa on the coast or occupying elevated sites on the seaward spurs of the Kaitake Range. While unknown historical factors may be crucial in this, it might also be suggested that within this narrow strip of terrace country there was insufficient space for the network arrangement of fortifications that so clearly characterises the Tataraimaka district. Hence the only works which lie between the Oakura and Timaru Rivers are sited at the margins and possess the strategic command and tactical strengths outlined above for similarly located sites elsewhere in the survey area.

An outstanding aspect of Maori fortifications of the Tataraimaka district is their number within what is a very small area. Over twenty sites are concentrated in no more than 10 km^2 in the Pitone Stream and lower Katikara River area — and there are another six just outside the present survey area on the left bank of the river. Within the lower Katikara River valley eight pa are situated in an area no more than 1 km by 2-300 m. The marked similarity of many of these sites strongly suggests an historical association. Contemporaneity is sometimes indicated by complementary siting. Aspects of the distribution and similarity in form of many Tataraimaka sites point to the prospect of developing an historical model for sites of the district and the region as a whole.

Acknowledgements. I am grateful to landowners of the Tataraimaka district who were always interested in our work and generous with permission to visit sites. Thanks are due to the field team of Kelvin Day, Roger Fyfe, Robyn Oliver and Max Stevenson. The assistance of Kathy Prickett is gratefully acknowledged. Ron Lambert, Director of Taranaki Museum, gave his usual support and help. For accommodation at Oakura I am grateful to Messrs George Bowen and Trevor Burrell. Thanks are due to Caroline Phillips for the line drawings. Financial assistance was given by the New Zealand Historic Places Trust.

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EXCAVATIONS AT MAIORO, N51/5, SOUTH AUCKLAND, 1965-66

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Abstract. Excavations by R.C. Green in 1965-66 are described by Aileen Fox. The site is a scarped enclosure on a defensible knoll, near the west coast of the North Island of New Zealand and the ancient portage from the Manukau Harbour to the Waikato River. It was in the well populated territory of the Ngati Kahukoka, a sub-tribe of the Wai-o-hua. Excavations revealed four phases of occupation, shown by a succession of storage pits. The first was probably an open settlement; in the second the summit platform was scarped and defended by a palisade; a sleeping house with an associated working floor and a cooking shed were built. The defences were subsequently reconstructed and pits were replaced. In the final phase pit storage was outside the enclosure where one large pit with elaborate timberwork was examined. Radiocarbon dates are not yet available.

The excavations at Maioro were planned by Roger Green as a continuation of his previous work at the open settlement near Kauri Point in the Bay of Plenty (Green 1963). The object of this sustained research was to define and date a variety of Maori open settlements in New Zealand which at that time were little understood or appreciated. At Maioro it was intended to examine a type of small terraced settlement which lacked the obvious earthwork defences of a pa, but unlike that at Kauri Point, was placed in a defensible position. The site also provided an opportunity to explore the layout of a summit platform *(tihi)*, with its implications for the organisation and the use of resources by a Maori community of hamlet size.

Maioro was selected because it lay in an area of South Auckland where no excavation had previously taken place and where field survey had shown there was a concentration of similar types of settlement, as well as fortified pa (Figs. 1,2). This has since been confirmed by an examination of air photographs by Steve Edson, New Zealand Archaeological Association filekeeper for the Waikato, and by a ground check in 1982 by Fox.

The excavations were carried out from 26 December 1965 to 15 January 1966 with students and other members of the University of Auckland Archaeological Society under the direction of Roger Green. The owner of the site, Mr C. Thompson, willingly gave permission for the work and a field camp near his farmhouse. Moreover, he took a keen interest in the excavations, and was most helpful throughout, especially when it came to backfilling the excavations with his farm tractor. Funds to support the excavation were supplied by a grant from a special Pacific Research Fund of the University of Auckland. In 1968, Green left New Zealand and was subsequently unable to complete his report. In 1981, it was suggested that Fox, Honorary Archaeologist at Auckland Institute and Museum where the Maioro material had been deposited, might write up the results and

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this has now been done. The report which follows is in essence a joint work, being based on the original field notebooks, plans and sections. The published illustrations incorporate some minor amendments and the text contains reinterpretations in the light of recent developments and of the specialists' reports.

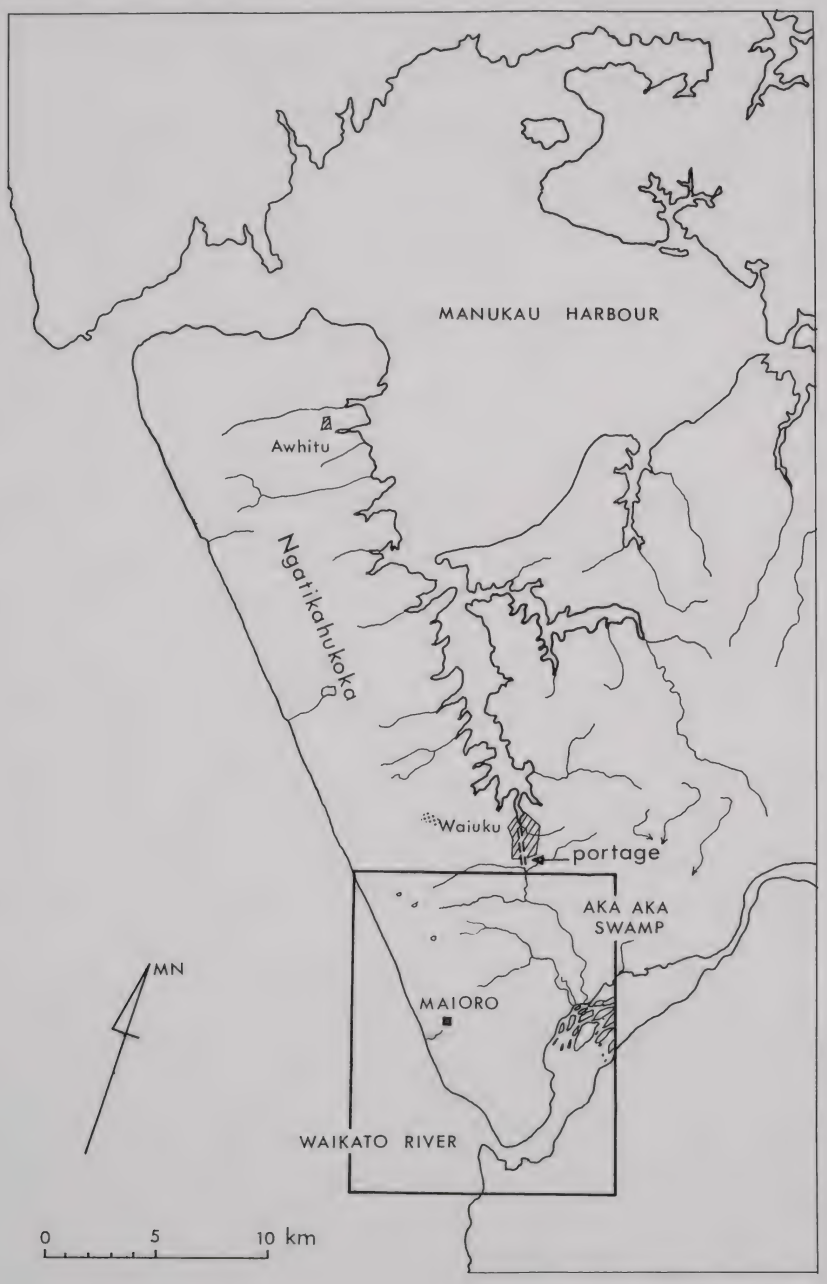


Fig. 1. Location map. For enclosed area, see Fig. 2.

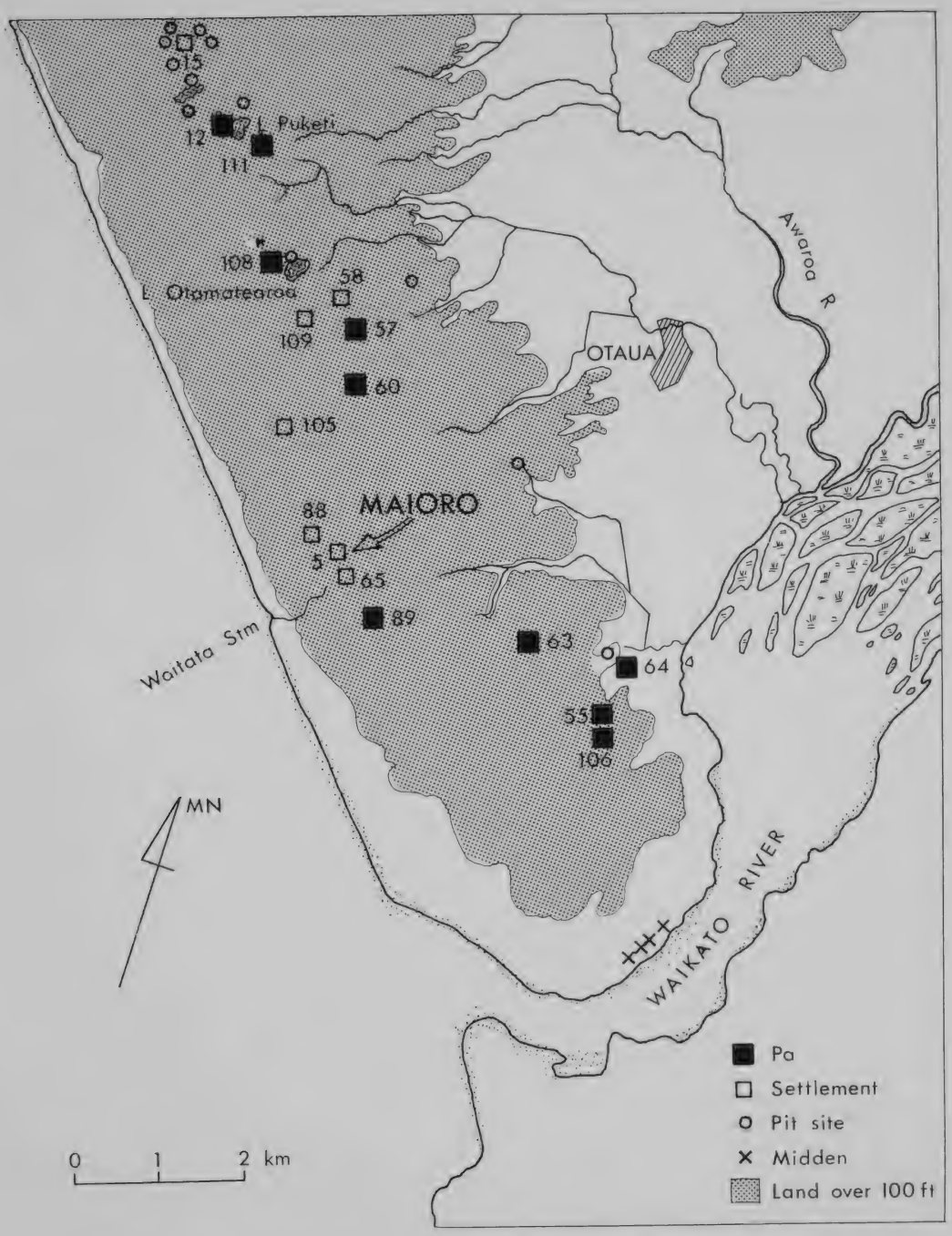


Fig. 2. Distribution of Maori sites in the Maioro district. The numbers refer to the N.Z. Archaeological Association site records on map N.51 Onewhero.

The setting (Figs. 1,2)

Maioro is situated near the southern end of an undulating sandstone ridge 100-200 m high that extends from South Manukau Head to the mouth of the Waikato River, lying parallel to the coast (Fig. 2). On the west side of the ridge, which is 4-5 km wide in the vicinity of the site, there is a steep escarpment with rocky exposures above a broad tract of sand dunes behind the present beach. The line of cliffs and dunes is broken by the small valley of the Waitata Stream known as the Maioro gap, which affords a landing place for canoes in fair weather. The eastern side of the ridge slopes gradually towards the modern township of Otaua and to the extensive alluvial flats along the lower Waikato River; these have been drained for farmland but in early times would have been swamp, probably with some narrow channels of open water. In the mid-nineteenth century there was a well known trade-route from Hood's Landing on the river through the Aka Aka swamp by the Awaroa River and then across the low saddle of land to Waiuku at the head of an inlet of the Manukau Harbour (Fig. 1). From there it was an easy journey by canoe to Onehunga. Goods to and from the Waikato were sent by this trans-peninsula route to Auckland (Sorrenson 1981:172), utilising the portage known to be of prehistoric origin. The settlement at Maioro and others in the neighbourhood therefore were not in a cultural backwater but in an area adjoining an important line of communication.

According to Maori tradition as related to John White (1888:116) in the late nineteenth century, the coastal zone was settled by the Ngati Kahukoka, a people belonging to the Wai-o-hua tribal confederacy of the Auckland Isthmus.

> ". . . the Nga-ti-kahu-koka were a brave and numerous tribe, and occupied the district from the entrance of the Manuka to the entrance of the Waikato River. They occupied many stockades *(pa),* some of which were on the peaks of the hills; others were built on stages erected in the lakes and swamps which are situated between Waiuku and the Maioro. But the principal *pa* or home of the tribe stood on the peaks of the hills, Puketapu and Titi, which were inland; and the stockades *(pa)* occupied by those who procured fish for the tribe were at Awhitu and Tipitai, near the entrance of Manuka"

Later another element in the population was the Ngati Teata, who acquired lands on the eastern Manukau in consequence of the marriage of a chieftainess, Te Ata-irehia, with a warrior, Tapaue, from the Waikato. She was the daughter of Huatau from Motukutureia pa (McLaughlin's Mountain). In the mid-eighteenth century, the Ngati Teata became the dominant force in the Waiuku area (Kelly 1949:243, 248; Muir 1980:1). According to White's informant, the name "Maioro" means "ditch outside of a pa" (White 1888:116). This is perhaps a reference to the Maioro gap, the narrow valley of the Waitata stream leading down to the coast.

Field surveys have shown that the district south of Waiuku was well populated by the Ngati Kahukoka. The sites are confined to the higher ground of the sandstone ridge, with marked clusters near the small lakes behind the dunes, Lakes Whatihua, Puketi, Otamatea and Parkinson's (Fig. 2). The fortified sites include three terraced pa N51/55, 57, and 60; the remainder have simple transverse defences, consisting of a ditch with a low internal bank above a steep artificial scarp. None are of the size and elaboration of the Kohekohe ridge pa, north of Waiuku N46-7/21 (Law 1969); though N51/12 situated on the narrow ridge between lakes Puketi and Rotoiti effectively combines three separate lines of transverse ditches and banks with terracing leading up to a prominent summit platform. Another sophisticated fortification is the ridge pa N51/89, with earthworks at each end,

featuring an external bank, suggestive of musket warfare. This pa may be the work of Ngati Teata in the late eighteenth or early nineteenth century. In general the fortifications are low key and rely more on natural defence than on the earthworks; from this it can be deduced that full use was made of palisades as a means of perimeter defence.

There are several hilltop settlements that, like Maioro, are defensively sited but lack earthwork defences (N51/15, 58, 88, 105; Fig. 2); excavations would probably reveal that these were also palisaded. The present classification, based on surface appearance is in this respect probably misleading and both types of site would be recognised by the Maori as a pa. There are many rectangular storage pits in the settlements, some very large, up to 12 x 10 m, and rock-cut (N51/105). There are also isolated pits and pit groups, some of which may belong to small open settlements. The Maori garden plots have not survived the intensive European farming and enclosures, but the pits show that much of the light friable soils of the sandstone ridge were extensively planted with kumara.

Geology and soils

The underlying rock is a cream coloured sandstone, a sedimentary rock of non-marine origin of the upper Wanganui series (N.Z. Soil Bureau 1973). In exposures in road cuttings it is covered by 1-1.5 m of soil which varies in colour from orange to a yellowish brown. On the Maioro ridge, the soil is dark brown, of a fine silky texture and very friable. Samples were submitted through Mr E. Cox of the D.S.I.R. Soil Bureau in Auckland to Dr G.E. Orbell, the northern regional pedologist at Ruakura, Hamilton, who reports as follows:

> 'The soils lie within the concept of the Red Hill soil set (24c Red Hill sandy clay loam) of Soil Bureau Bulletin 5 (1954) and are classified as a yellow-brown sand. The parent material for this soil is weathered sands with an admixture of volcanic ash. The sands are derived from coastal dunes blown up to high levels by way of sand ramps in the past. These coastal sands are derived from a variety of parent rocks including volcanics of various soils and contain many ferro-magnesium minerals derived from volcanoes such as Mount Egmont. There is also the known presence of airfall rhyolitic volcanic ash beds derived from the Rotorua-Taupo region, (Hamilton Ash formation, Late quaternary volcanic ashes) and even small additions of airfall Taupo pumice, all or some of which may have been incorporated into the original sands or later mixed with the soils during any soil creep, or even cultivation, periods.
>
> Generally speaking these soils would only be of medium to low natural fertility and have low plant available phosphorus and potassium. Physical limitations to plant growth include low plant available water (the soils are droughty) and the liability to wind erosion under open cultivation system including extensive burning operations.'

Site description (Fig. 3)

The scarped enclosure was sited on a conspicuous square-topped knoll, which rises from a 100 m high ridge between the Waitata Stream and a small tributary (Fig. 4): the site is *ca.* 1 km inland from the coast (Fig. 2). Both sides of the ridge fall steeply to the flat valley floors which until recently were swamps. The easy line of approach was from the south-west along the narrow ridge top which was blocked at the foot of the knoll by a transverse scarp (Fig. 5), and as the excavations showed, by palisades. These defences enclosed a rectangular summit platform measuring 18 x 14 m which was divided midway by a low transverse scarp. On the north-west side, the main defensive scarp was continued downhill to form a lower enclosure 25 x 12 m containing six visible storage pits. North of the enclosure the ridge is broken by a small steepsided gully and a spring which flows east; these afford a good natural defence to the hilltop site from the north-east and consequently

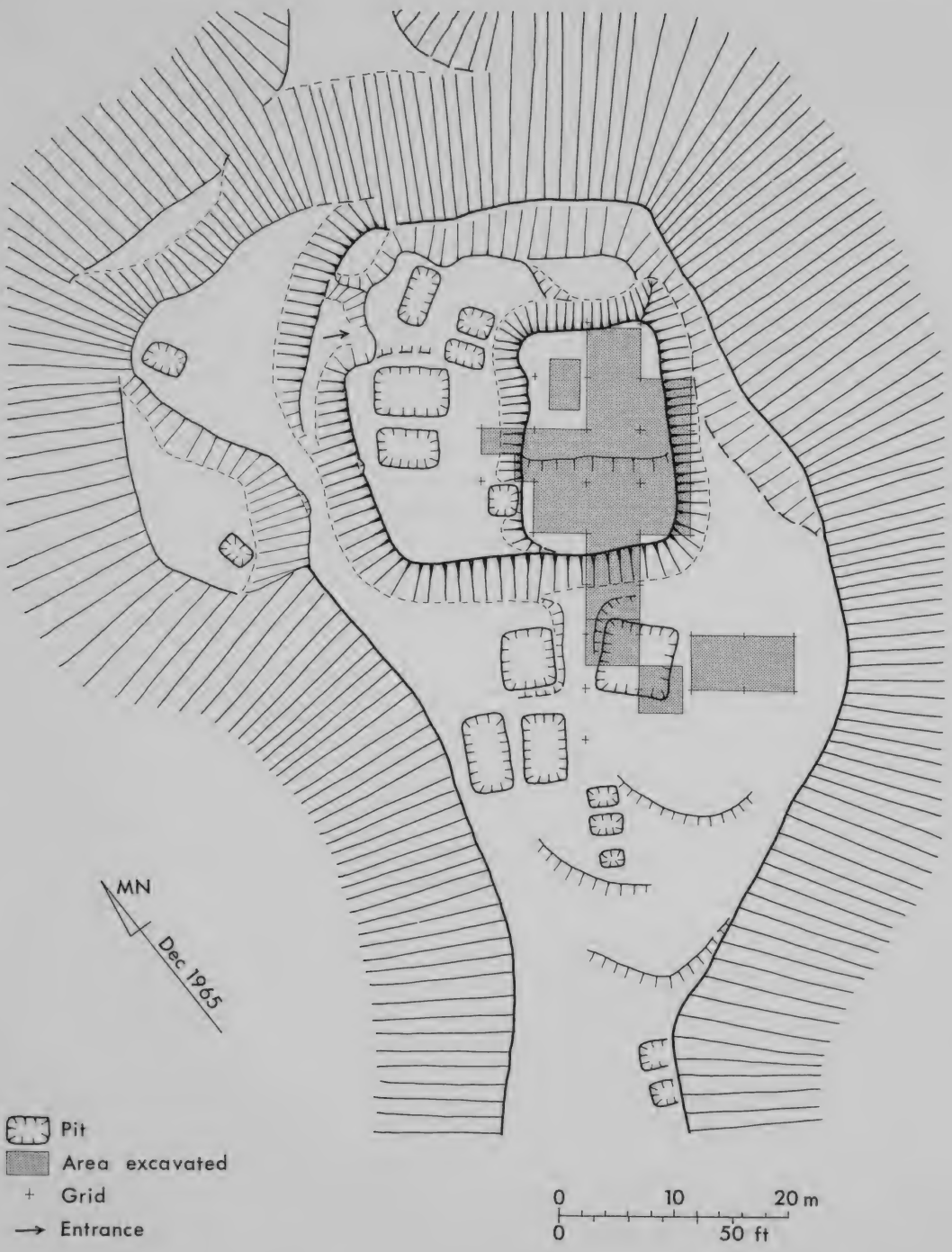


Fig. 3. Site plan of Maioro (N.51/5 G.R. 216 021). Stippling shows the areas excavated.

Figs. 4,5. 4. View of Maioro from the south. 5. View of Maioro looking north-east along the ridge. (Photos A. Fox)

the scarping of the lower enclosure ends at this point. The entrance appears to be on the northern slopes through a recess in the scarp of the lower enclosure indicated by an arrow on Fig. 3. There was no obvious entry in the summit scarps but excavation indicated a narrow gap in the palisade in the middle of the north-eastern slopes, flanked externally by timberwork (Fig. 6). To reach it, all comers would have to pass close to the foot of the palisaded scarp, within range of missiles from the defenders, before ascending the final steep slope to the gateway.

Outside the defended zone there are three terraces on the lower slopes on the north-western side, two of which contain a visible storage pit. On the ridge top to the south-west there is a group of four large and three small pits including the 6 m square pit 10 which was excavated (Fig. 15), as well as some slight indications of terracing. There is a spill of shell midden exposed at the edge of the south-east slopes. Surprisingly there is no sign of an earthwork defence where the ridge dips slightly and narrows to 12 m, so that access to the summit platform from this direction is easy (Fig. 5), making the site difficult to classify as a pa on surface evidence alone. There are two other groups of pits and terraces further along the ridge (Site N51/65) showing that the area was well populated and cultivated despite the absence of surface indications of drains or divisions for garden plots. The friable sandy soils would have been easy to clear and to cultivate. Other advantages of the site were easy access to the coast by way of the Maioro gap for sea fishing in calm weather. Eels would be obtainable in the nearby swamps and shellfish from the beaches at the mouth of the Waikato, where there are middens (Fig. 2), or from the eastern side of Manukau Harbour.

Aims and methods of excavation

The area investigated consisted of the greater part of the summit platform *(tihi),* with extensions to cross-section the perimeter scarps on three sides (Figs. 3, 6). The intention was to obtain evidence for the lay-out of a *tihi* and to ascertain the character of the defences. Half of the largest pit (Pit 10, Fig. 15) in the group on the ridge adjoining was cleared by the quadrant method in order to examine its construction. Another cutting was made between this pit and the edge of the steep slope to test for occupation and the stratigraphic relationship of the big pit to the summit platform.

Initially a base line 150 ft (45.7 m) long was laid along the axis of the ridge and from it a grid of 15 ft (4.6 m) numbered squares was set out, shown by '+' on fig. 6. The squares were lettered A to H across the ridge though in neither direction was the nomenclature fully utilised. At the start, 2 ft (61 cm) baulks were left between the squares but in many cases these were eliminated as the excavation progressed. The work will be described in detail under three headings: (1) the defences, (2) the interior and (3) the external features. These sections will be followed by a summary of the phases and chronology of the occupation and a discussion. Since the original measurements were in feet and inches, these have been retained, with the metric equivalent added in brackets.

The defences

The character of the defences was complicated by refilled pits of a previous occupation on the hilltop (Pits 6, 7, 9; Fig. 6) and by subsequent digging of *rua* pits into the scarp. On each side, however, it was clear that there were lines of substantial postholes, often well behind the top of the scarp, indicating the position of the palisades.

Fig. 6. Plan of the excavations: for sections see Fig. 8.

On the south-east side, in Squares E6, 7 and 8 there were two alignments (Fig. 7): the outer consisted of holes 12 to 15 ins (30-38 cm) in diameter and 15 to 24 ins (38-61 cm) deep: the inner were smaller and shallower, 6 to 9 ins (15-23 cm) in diameter and 12 to 14 ins (30-36 cm) deep. In the cross-section Z on Fig. 8 it is clear that the postholes of the inner line are related to the latest stratum and therefore this palisade was an addition to, rather than a replacement of the more massive timberwork of the outer palisade. It formed, in effect, a double palisade. Both lines continue in E7 and 8, though the inner line has been obliterated by Rua 3: traces of deep holes of the outer line were found on the floor of Pit 6, and continuing beyond. Similarly on the south-west side in Square F9, there were indications of two periods of palisading: the two sets of holes were close together (Fig. 6) but the larger and deeper holes were at the top of the scarp and were related to the lower strata (Sections X and Y, Fig. 8). Some charcoal from the postholes has been sent for radiocarbon dating. The posts had been set up in post-pits, indicated by short lines of scarping on the plan, which were then repacked. This method of construction was not fully understood by the excavators in 1966, so in general only the post moulds were discovered and marked on plans. The smaller posts were in front of the larger ones and were associated with a narrow irregular bedding trench (Fig. 9); this presumably held the bases of the stakes between the uprights. A similar feature was found at Mount Roskill pa in Auckland (Fox 1980:48). The excavation was complicated by a drain which crossed the bedding trench at right angles and by the filling of an early pit or pits. This appears in the sections X and Y (Fig. 8) and is shaded on the plan (Pit 9, Fig. 6): the intervening area was not excavated. Since this side of the enclosure was open to attack from the level top of the ridge, there was a defensive bank at the top of the scarp. To make it, the filling of the underlying pits had been cut through and more soil dug from an irregular quarry hole. Subsequently the bank had collapsed, as shown in the sections by a thick sloping layer of

Fig. 7. Palisade postholes of two periods in E7, on S.E. side of the enclosure.
On right the scarp of an earlier terrace.
(Photo R. Green)

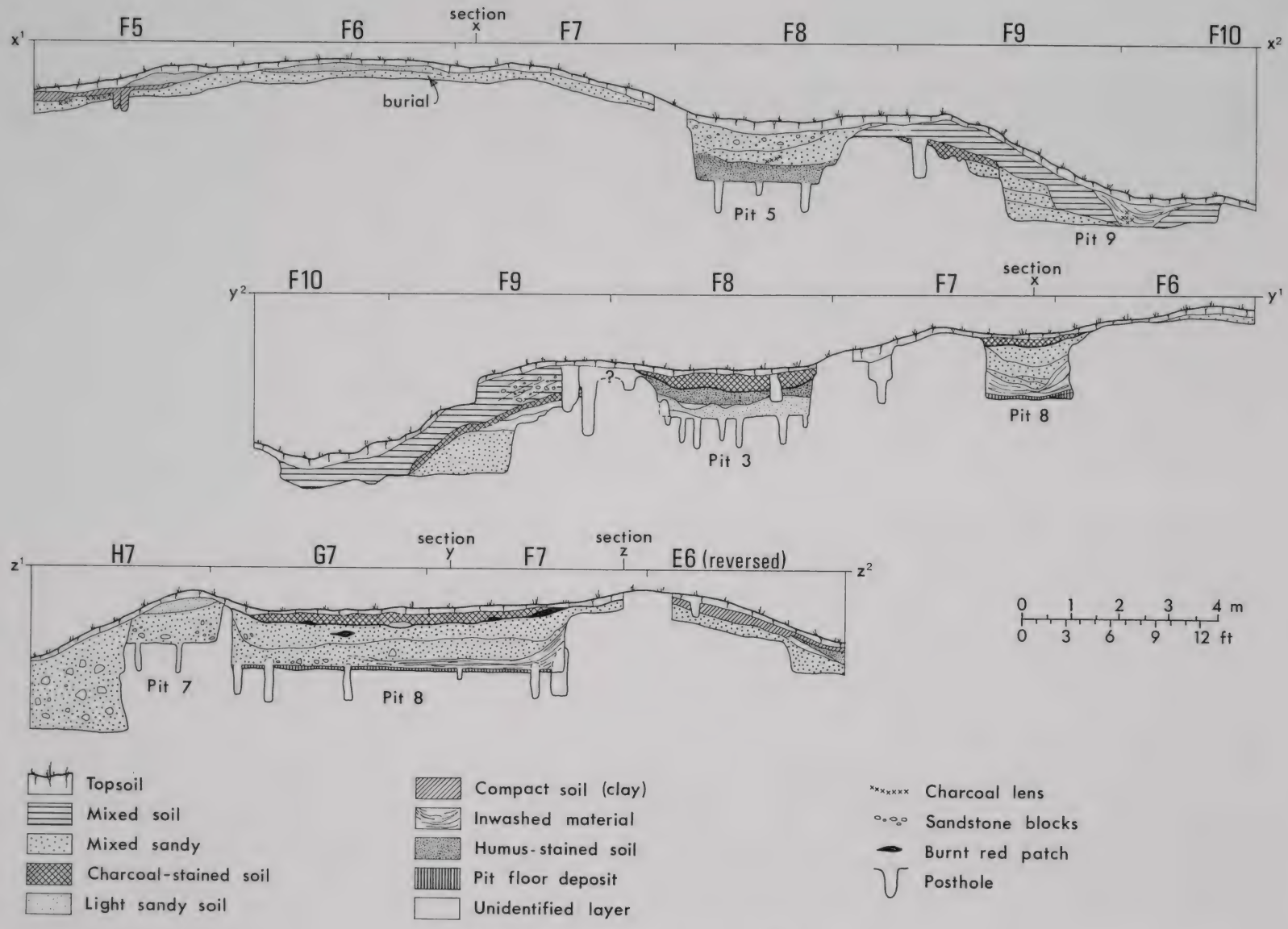


Fig. 8. Sections: for position, see Fig. 6.

Figs. 9,10. 9. Palisade postholes and bedding slot in F9, cut across by drain. The ranging pole marks a late period palisade post and the defensive bank. 10. Postholes of the reconstructed palisade in F5. The tip of the ranging pole crosses the probable entrance gap. (Photos R. Green)

mixed soil, which partly refilled the quarry; finally a small V-shaped ditch was dug in the centre of the slip (Section X, Fig. 8). A slight surface hollow at the foot of the scarp on the south-east side suggests that the quarry ditch formed by this process may have continued around the corner.

At the opposite north-east end of the enclosure, which faced the slopes to the head of the gully, there was evidence in Square F.5 that palisades had been constructed at two periods but on the same alignment (Fig. 10). In two places the larger and deeper postholes of the early palisade had been cut into by the smaller postholes characteristic of the later palisade (Section X, Fig. 8), and others had been inserted in the intervals. There was also evidence that some early posts had been burnt and the holes covered with a layer of 'clay'. A sample of charcoal from the lowest layer has been submitted for a radiocarbon date.

Outside the palisades there was a group of six large postholes (Fig. 6); these were shallow holes 6-16 ins (15-41 cm) deep and presumably contemporary with the similar holes of the reconstructed late palisade. A possible explanation is that they belong to a

timbered entrance reached by way of the outer enclosure along the steep hillside (Fig. 3). A similar arrangement of external posts was found at the entrance to Pari Whakatau pa, Claverley in the South Island (Brailsford 1981: Fig. 134, 148). Alternatively they may belong to an early structure unrelated to the defences. The remaining north-west side, while also palisaded, was screened by the outer enclosure below. In the half-square H7, it was found that the defensive scarp was superimposed on the filling of an early pit (Pit 7, Fig. 6) and later had been cut into by a *rua* (Rua 2). The section (Z on Fig. 8) showed that some light soil had been heaped over the pit filling to heighten the scarp. Two substantial postholes were located which penetrated the pit filling, indicating there was also a palisade on this side. The line was continued beyond the pit by two postholes, 22 and 18 ins (56 and 46 cm) deep in the adjoining G7. Since the defensive scarp was cut into by an external pit visible on the surface (Fig. 3), as well as by the *rua*, it is probable that in the latest period the north-western defences were concentrated on the outer perimeter of the lower enclosure.

The interior (Fig. 6)

Two occupation areas were located in the interior, one at the higher north-east end and the other below the transverse dividing scarp. The remaining space in each division was taken up by a series of rectangular storage pits, Nos. 3-6 aligned axially, and Nos. 1-2 and 8 aligned transversely. None of these pits were visible on the surface before excavation. Elsewhere it was difficult to identify individual structures from the numerous small postholes and to establish a construction sequence from the scanty occupation deposits.

Traces of a timber structure, a working floor and a burial were detected in the upper occupation area (Squares F, G, 5-6-7). A series of slots 9-12 ins (23-30 cm) deep, suitable for bedding timber wall-slabs, and a row of small postholes aligned at right angles suggested the position of a rectangular house facing south-east. The front wall was indicated by two slots 8 ft (2.4 m) apart, whilst a third at right angles, together with another similarly placed depression, suggests there was a porch or shallow verandah. The row of three holes can be interpreted as central roof supports and two others give the position of the northern side wall in line with the verandah slab. The position of the other side and rear walls lay outside the area excavated. The maximum dimensions which allow the house to stand clear of the defences and of Pit 8 would be about 5x3 m overall. The completed house plan is shown in the reconstruction (Fig. 11).

In front of the house as thus conjectured, there was a working floor with a concentration of numerous small flakes and pieces of obsidian, including several cores. A hammerstone (Fig. 20), a polisher (Fig. 19), pieces of water-worn pumice and some red ochre were also present. On the south side of the house there was a long pit, Pit 8, 21 feet long, 5 ft 6 ins wide and 4 ft 6 ins deep (6.4 m, 1.7 m, 1.4 m). It had a central row of five deep postholes on the floor to hold timber supports for a ridge pole (Fox 1974:143); the largest one at the end was probably a replacement. Other postholes suggest that the floor was divided into compartments, either bins or racks for storing kumara or other produce. A seam of dark soil on the floor had accumulated when the pit was in use followed subsequently by slips from the sides, and then by a deliberate filling of mixed sandy soil (Fig. 12, and Section Z, Fig. 8). This was covered by a layer of dark soil with charcoal which should relate to the latest occupation of the site. Whether the long pit was in use when the house was first occupied is therefore uncertain, but since the two structures are in a similar alignment, it seems very likely. Charcoal from a posthole in the pit has been submitted for radiocarbon dating.

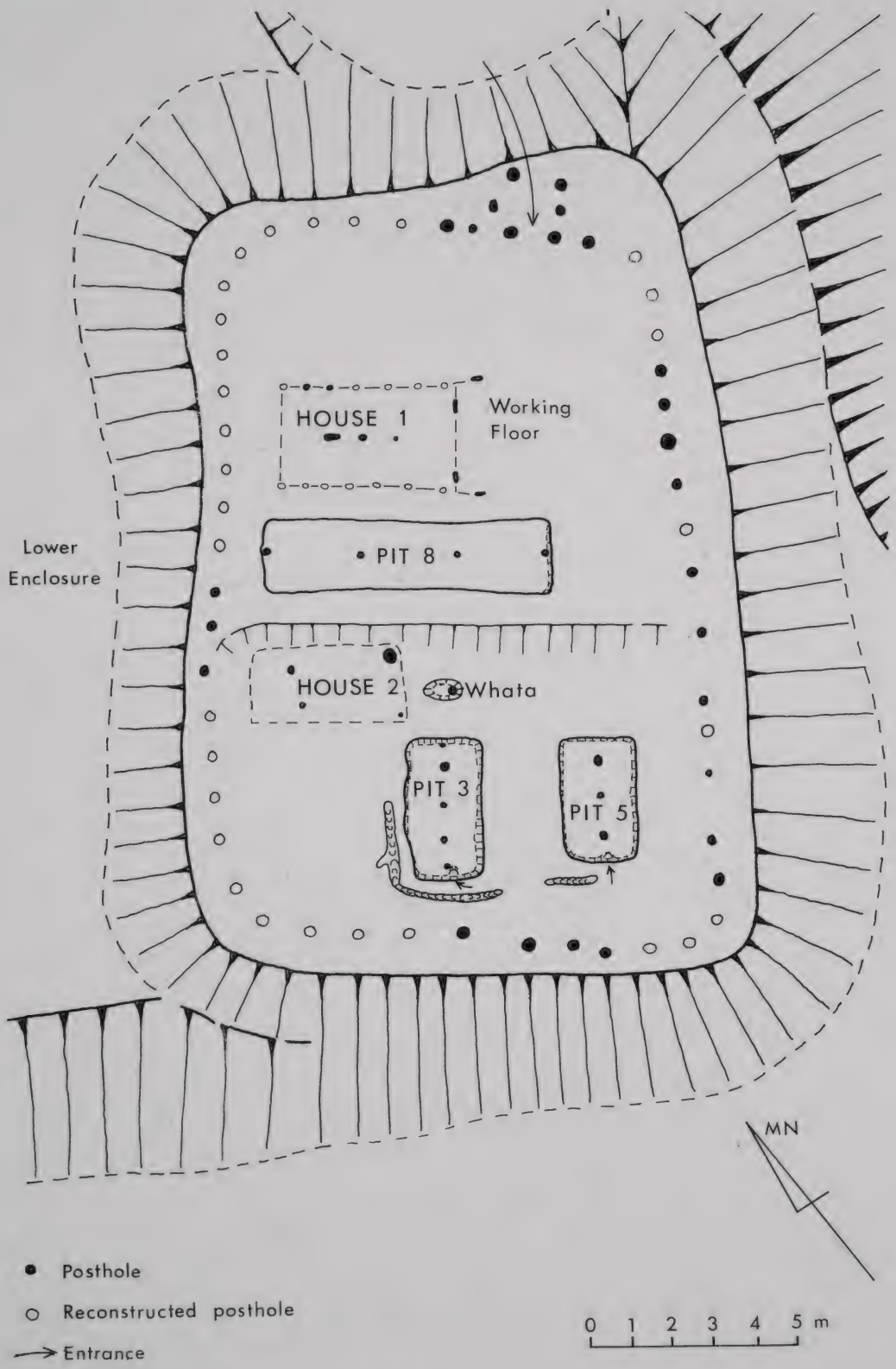


Fig. 11. Reconstructed plan of the palisaded enclosure on the summit.

Fig. 12. Long Pit 8 in cross-section, showing layering. (Photo R. Green)

To the north-east, just outside the proposed side of the house there was a small scoop firepit 4 ins (10 cm) deep. A small adze or chisel (Fig. 18) was also found here. North-east of that were a semi-circular depression and miscellaneous postholes and hollows, suggesting the area was used for domestic activities although no definite structures were found. This area of the summit had been covered by the excavation spoil dump and only a small part of it was able to be hastily examined on the last day during the fill-in.

A burial was found on the south-east side of F6: the depth was not stated but Green's notes record that the bones were 'just under the floor of the later occupation and after the infilling of long pit 8'. The grave presumably cut through the lower layer shown in section X (Fig. 8). The remains consisted of 'two articulated legs with pieces of pelvis attached'. A skull was found in the adjoining baulk, from which it was deduced that 'this is likely to be a burial in that the remaining bones are articulated and the head is in the correct position if the vertebral column now missing is inferred'.

Dr Philip Houghton of the Anatomy Department at Otago University Medical School kindly examined the bones and reports as follows:

> 'These very fragmented, eroded remains are from a mature Polynesian (Maori) male. The teeth offer the most data; they are severely worn, particularly on the first molars, and in my experience this places them fairly securely in the later prehistoric era, say AD 1550-1800. The wear pattern is clearly not of the 'fern-root' variety. We now have reasonable evidence that the fern-root plane on teeth is indeed most likely to have arisen from the prolonged chewing of the rhizome, so it is reasonable to conclude that this individual did not have it in his diet. I would tentatively age him as 26-32 years.'

The other occupation area was located in Squares G7 and 8 at the foot of the low transverse scarp (Fig. 6). It was superimposed on a collapsed store pit, Rua 1, which had

been partly filled with stones. The *rua* measured 2 ft (61 cm) deep with undercut sides, expanding from 18 ins (46 cm) at the mouth to 4 ft (1.2 m) at the bottom. A row of small storeholes, Ruas 4, 5 and 6, 2 ft (61 cm) in diameter and 18 ins (46 cm) deep were thought to be similar constructions of the early period. There was a rectangle of trodden floor, 12 ft (3.7 m) long and 6 ft (1.8 m) wide from the foot of the scarp, beyond which it faded out. There was a hearth with 6 ins (15 cm) of burnt soil and charcoal with a 17 ins (43 cm) deep stakehole at the edge, perhaps to hold a forked support for a spit. Some burnt rushes *(Juncus* sp.) were also found here. Many flakes of obsidian, worked and other worn pieces of pumice (Figs. 23, 24) as well as a few shells *(Paphies/Mactra* spp.) were recovered from the floor deposits. Only two or three postholes were located at the edges of the floor (Fig. 6) but others may have been missed in the filling of the collapsed Rua 1. The superstructure is thus ill-defined: it could have been a lean-to construction, a cooking shed rather than a sleeping house.

A deep posthole in a well-cut post pit was located outside and to the east of the floor. The unusual profile shown in Section Y (Fig. 8) suggests that the post was intended to stand alone: it probably supported a rack or a small structure *(whata)* in which choice provisions were kept; both are known from early nineteenth century drawings (Murray-Oliver 1968: Pl. 19.). A fine polished argillite adze (Fig. 17) was found in loose soil nearby.

South of the occupation area and structures of Squares F and G7 there were two pits, Nos. 1 and 2 set transversely and four others set longitudinally in a neat row across the enclosure (Fig. 6). Of these Pit 6, 3 ft 2 ins (1 m) deep, clearly antedated the construction of both the early and the late palisade; the postholes in alignment with those in E6-7 were found in the filling and those of the early palisade penetrated to the pit floor. There was also a *hangi* on top of the pit filling, 11 ins (28 cm) deep and containing 5 lbs (2.3 kg) of burnt stones. The small Pit 4, only 18 ins (46 cm) deep must also be assigned to an early date since one side of it had been cut away by the adjoining Pit 5 and the filling of 'clean sandy loam' was homogeneous. A buttress step indicated an entry at the upper end and there were two drainage channels for surface water at the lower end. Pits 1 and 2 were rock-cut pits, 2 ft 6 ins (76 cm) deep with clean fillings and their well-cut sides intact, suggesting that they had been little used and deliberately refilled at an early date. They were described by Green as 'bin pits', but since both had two central posts on the long axis, they must have been roofed.

This leaves the largest pits, 3 and 5, as likely to be of late date and in use when the nearby house or cooking shed was last occupied. Pit 3 was 3 ft (91 cm) deep with a sandstone rock floor; there was a rock-cut step at the lower end indicating the entry and a central row of six postholes for holding the roof supports (Fig. 6 and Section Y, Fig. 8). Since the holes are unnecessarily close together, some were probably dug for replacements when the pit was re-roofed. There was an external drainage gutter around the lower side and end. The pit filling consisted of sandy soil, with a seam of charcoal at the bottom, which had accumulated naturally to a depth of 2 ft (61 cm). The remaining infilling was burnt soil with charcoal, probably the throw-out from a *hangi*. A large posthole 11 ins (28 cm) square was found in the upper filling (Section Y, Fig. 8); it is likely to be of historic age.

Pit 5 was 4 ft (1.2 m) deep: like Pit 3 it had an entrance step at the south eastern end and two deep square postholes with a small shallow one between them on the centre line for roof supports. In the middle of the floor there was a patch of burning, probably the remains of a fire lit to disinfect the pit (Fox 1975:203). The lower filling was of dark humus-stained soil, probably the remains of a collapsed roof with a covering of earth; above this was a deposit of loose sandy stony soil which had slipped from the sides (Fig. 13 and Section X, Fig. 8). There was a short length of external drainage gutter at the lower end of this pit, similar to Pit 3. Green was of the opinion that this pit was open at the time of the abandonment.

External features

The largest pit in the group on the ridge south-west of the enclosure, Pit 10, was excavated by the quadrant method in Squares F10-11 and E11-12 (Figs. 14, 15). In this way half of the pit floor was uncovered in opposite quarters and two cross-sections were obtained (Fig. 15). The method is economical in terms of the bulk of soil to be moved, but it is not as satisfactory as total clearance in terms of structure.

The pit measured 20 ft (6.1 m) square externally and had a low bank on the windward north-west side. It was surprisingly shallow, the floor being only 2 ft (61 cm) below the turf. The sides were dug in sandy loam; there was a thin trampled layer of stained soil on the pit floor in which a series of postholes filled with clean sand was detected (Fig. 14). Apart from one small slip from the side (Section W, Fig. 15) the filling consisted of dark soil and rubbish, including 18 lbs (8.2 kg) of burnt *hangi* stones, a few snapper bones, some charcoal and many shells, obviously a deliberate infilling when the pit was disused. The shells were almost entirely small *pipi (Paphies australis)* with a very few cockles *(Chione stutchburyi)* and *Mactra* sp. A sample was sent for radiocarbon analysis. Among

Fig. 13. Pit 5, showing central row of postholes and lower filling of dark soil, probably from the collapsed roof. (Photo R. Green)

Fig. 14. View of Pit 10, during excavation. (Photo R. Green)

the numerous postholes, five rows were distinguished by the excavator as structurally significant. The rows were consistently spaced in both directions, although there were minor irregularities. The holes in the rows varied in depth from 14 to 24 ins (36-61 cm); the remainder were smaller and shallower, nearly all less than 12 ins (30 cm) deep and make no discernible pattern (Fig. 15). There were no internal drains on the pit floor and no indication of an entry was found in the area excavated.

The interpretation of the roofing of this large square pit is difficult, particularly since it lacks an obvious axis. On the assumption that this lay approximately NE-SW, it would appear that the weight of the roof was carried cantilever fashion on rows 2 and 4. These contain most of the deeper posts, 17-24 ins (43-61 cm), whereas in the centre row 3, the posts were only 15-16 ins (38-41 cm) deep. The gabled roof however, would need a ridge pole at the apex carried on the central supports. Rafters would then rest on the intermediate horizontals and be tied at the apex with fibres. The spaces between would be filled with interwoven reed matting and the whole covered with thatch. It is known from some districts that pit roofs were earth-covered as a protection against frost (Best 1916:93), but at Maioro this should not have been needed, though it would help to explain the numbers of close-set posts to carry the roof. The two remaining side-rows, 1 and 5, are not necessary for roofing. As previously suggested (Fox 1974:146), they probably belong to the framework of a series of bins or racks at the sides of the pit, used for storing either different varieties of kumara, or crops belonging to different families in the settlement.

Between Pit 10 and the defensive scarp of the summit platform remains of another very large pit, Pit 9, were discovered. Its north-east end was intact as was a remnant of its south-east wall (Fig. 6, Squares F9-10). A size over 14 ft (4.3 m) for one side is indicated for it.

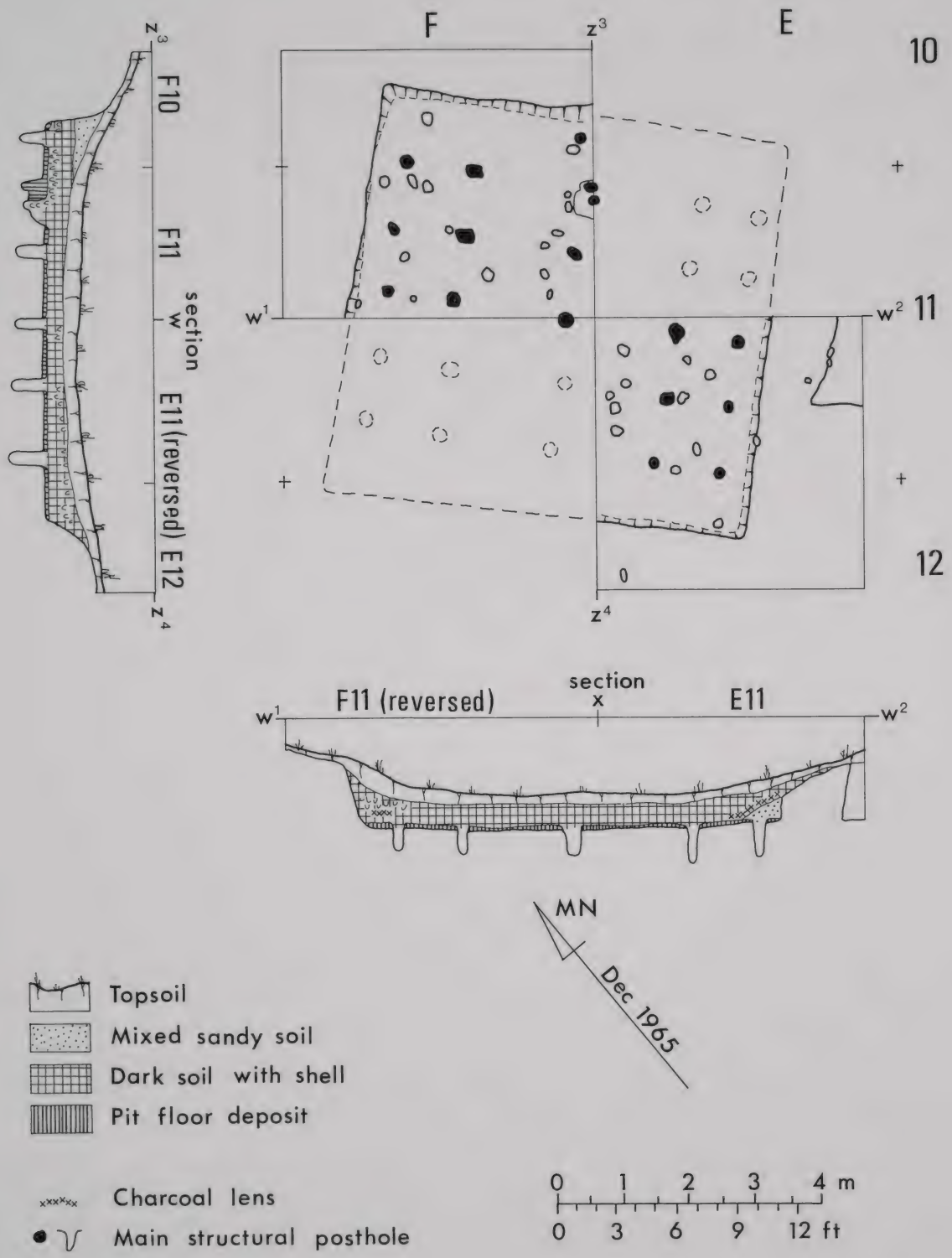


Fig. 15. Pit 10. Plan and section.

Two more squares, C-D11, were opened on the slope to the east of Pit 10 (Fig. 3). They were unproductive of structures, though the ground appeared to have been levelled. A *hangi* was found just below the turf and a small imported argillite adze (Fig. 16) was found in made ground at a depth of 17 ins (43 cm) together with a sandstone rubber (Fig. 21).

Catalogue of finds

Numbers in brackets refer to the original Catalogue in the Anthropology Department, University of Auckland.

Stone

Adze (Fig. 16), dense grey polished surface, metasomatised argillite from Ohana quarries, D'Urville Island. A small implement with angular bevelled sides: the cutting edge shows only a few marks of use.
Sq. C11, In mixed soil, 17 ins (43 cm) deep (No. 1997); with sandstone rubber (Fig. 21)

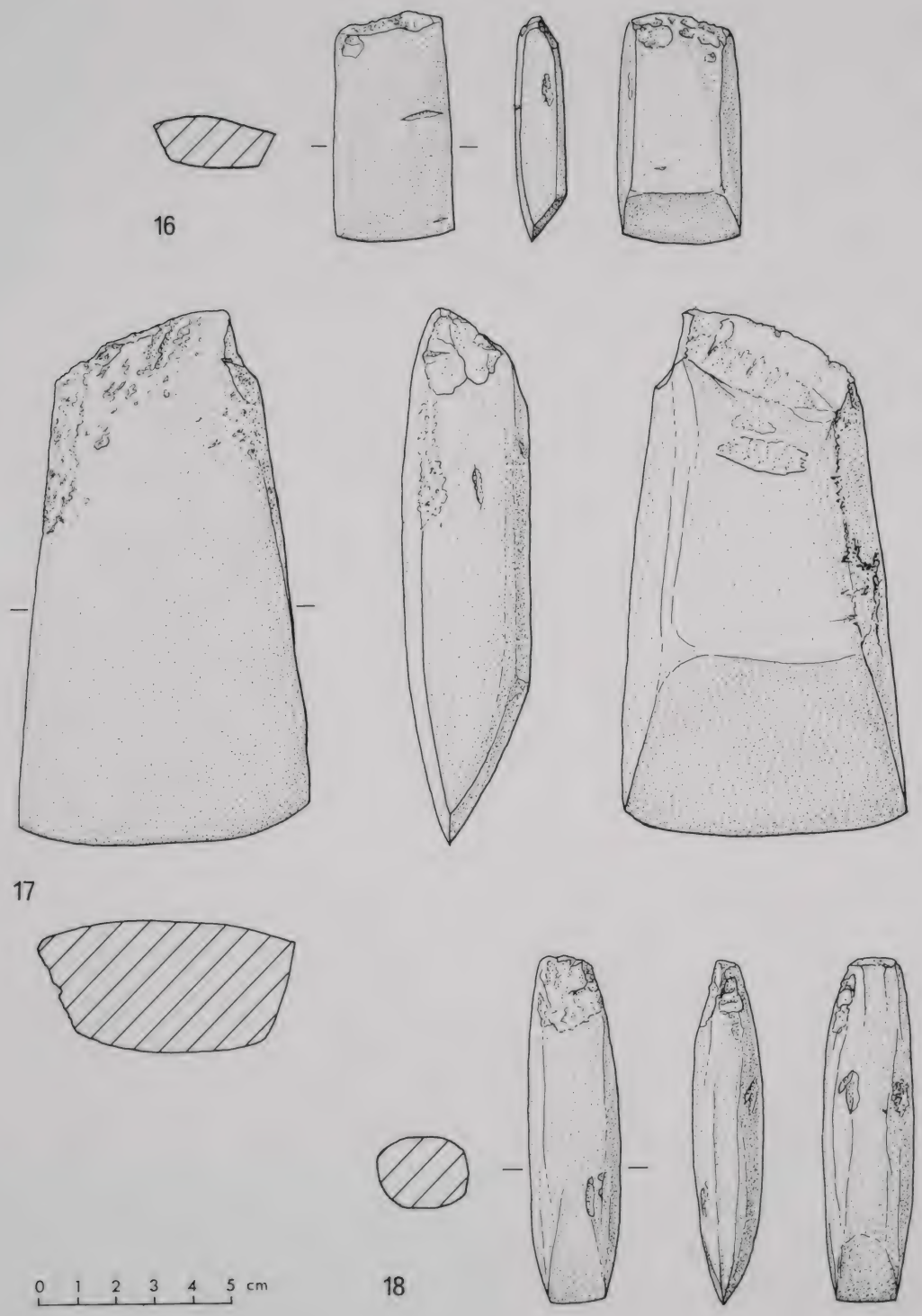
Adze (Fig. 17), dense greenish-grey polished surface, metasomatised argillite from Ohana quarries, D'Urville Island. The cutting edge shows it was little used. There is hammer-dressing visible on the sides and lower end, whilst the sloping butt has acquired a surface polish from friction in the haft.
Sq. G8, 'In loose brown filling beside posthole'; (No. 2026).

Adze or chisel (Fig. 18), dark polished surface, greywacke, probably from a local source such as a river or beach pebble. Part of the butt is left rough for hafting.
Sq. G5/6, Top layer, NE of House 1. (No. 2013).

Figures 16 and 18 are both small implements suitable for use as chisels by a wood carver. Figures 16 and 17 are made of imported material from the South Island, the metasomatised argillite characteristic of the Nelson mineral belt. The source has been identified by Mrs K. Prickett as the Ohana quarries on D'Urville Island (Walls 1974). A third small adze in the same material was found at Whiriwhiri (Waiuku Museum no: 2252) and part of another from Wattle Bay is in the Brambley Collection, Auckland Museum. (N. Prickett, report in preparation). The adzes are likely to have been imported as finished products (Challis 1976:484) and, as such, will have had a prestige value for the owners. Whilst the large archaic argillite adzes of Type 1A are well known as is their distribution to the Wairarapa (Prickett 1979) and Hawkes Bay (Fox 1982, Fig. 4.1.), the later products of Type 2B and other variants are less generally appreciated. The Maioro adzes indicate that an export trade continued into the fifteenth and sixteenth centuries, probably in the form of gift exchange. They indicate an early trade route to the west coast of the North Island from D'Urville Island, perhaps via Taranaki.

Stone polisher (Fig. 19), a greenish metamorphosed greywacke with white quartz inclusions. The rounded edges and sides have been hammer-dressed and there is a circle of highly polished surface on the flat top, presumably made by use.
Sq. F6, Working floor: above lower layer (No. 2038).

Hammerstone (Fig. 20), a waterworn pebble of andesite breccia, probably from the Waitakeres originally, with battered surface at narrow end.
Sq. F6, Working floor: lower layer (No. 2080).



Figs. 16-18. Stone adzes.

Rubbing stone (Fig. 21), fine grained, pale brown quartz sandstone: part of a thin slab worn hollow by extensive use on both sides.

Dr Kerry Rodgers of the Geology Department, University of Auckland reports that "this is a very mature well-sorted quartz sandstone, a silica cement. It is not of local origin, unless of some very localised outcrop, and is possibly from Taranaki or the South Island. It resembles the Sydney — Hawksbury sandstones in Australia and conceivably reached the Waikato as ship's ballast in the 19th century."

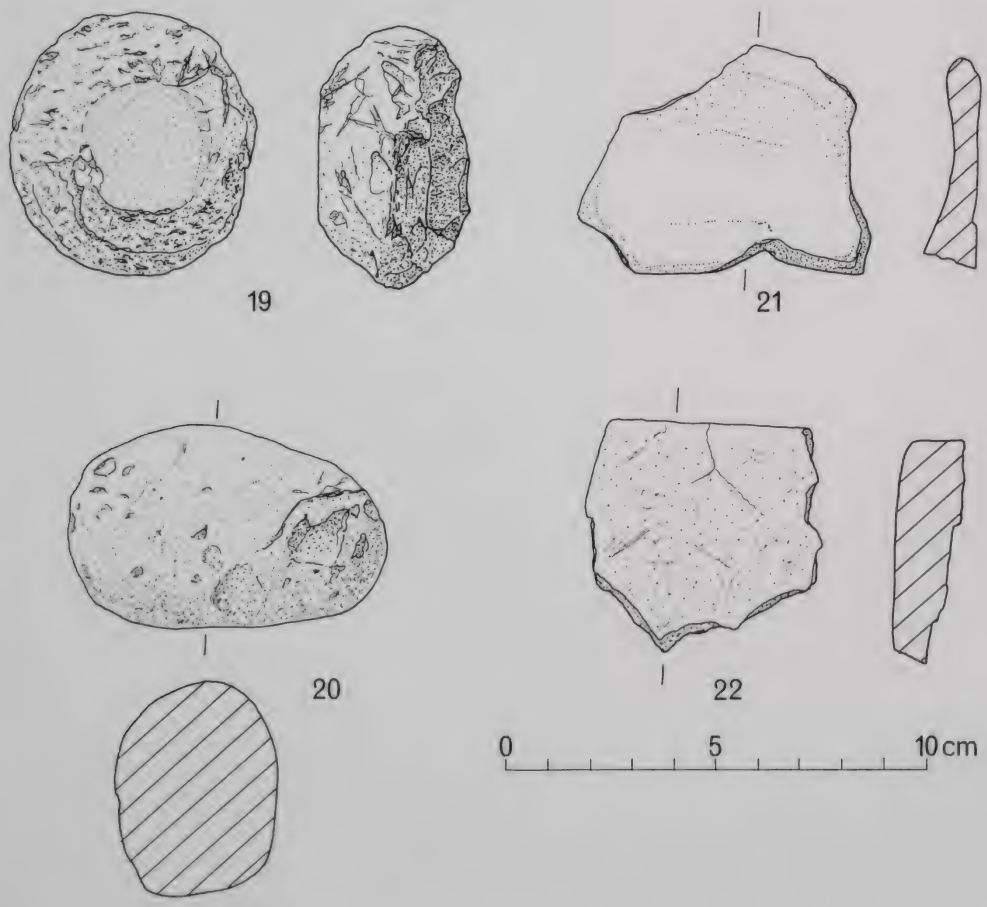
Sq. C11, 9 ins (23 cm) down, under surface layer (No. 1998/2).

Rubbing stone (Fig. 22), dark surfaced basalt: a broken rectangular thin slab with smooth top and sides showing thin lines and other marks of use.

Sq. F9, no details. (No. 2030).

Pumice

All the excavated areas produced pieces of water-worn pumice varying from small scraps to blocks 27 cm long. The material is obtainable from the sandy beaches at the mouth of the Waikato River and can also be found on the Tasman Sea beaches below the



Figs. 19-22. 19. Stone polisher. 20. Hammerstone. 21,22. Rubbers.

Maioro gap. It will have been carried down river from the Taupo region. The material was brought to the settlement for use as an abrasive, or for working into floats for fishing nets as Fig. 23, or possibly for carving (Fig. 24). A large block from Onewhero on the south bank of the river was carved into a head with a container for bones at the back and set up in a *wahi tapu* (Archey 1977:Fig. 192)

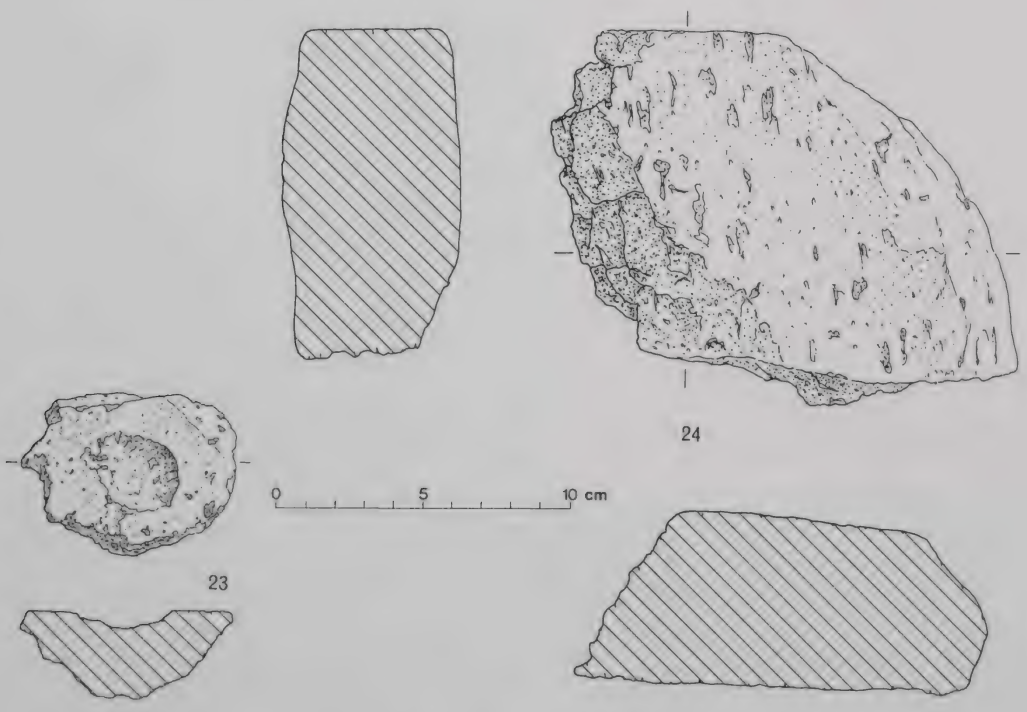
Pumice (Fig. 23), worked: the sides have been trimmed and the upper surface smoothed, with a circular depression *ca.* 30 mm in diameter roughly cut in the centre. Perhaps an unfinished net float.
Sq. G7, 'In hole adjoining G8', probably a posthole at edge of cook-house floor (No. 2019).

Pumice (Fig. 24), block: both sides and base have been flattened, and the curved side has been smoothed and rounded. The flat base suggests the slab may have stood upright and perhaps belong to a carved figure.
Sq. G7 extension, no details but close to cook-house floor (No. 2021).

Obsidian

Approximately 960 small pieces of obsidian were recovered from the excavations. Their probable sources, as determined by Dr Bruce McFadgen from a visual examination, are as follows:

Mayor Island	387
Great Barrier Island	487
Not identified	87



Figs. 23,24. Worked pumice objects.

These very tentative results are in line with other sites in the Auckland region (Green 1962, 1964; Ward 1973) showing that these two islands were the principal sources of supply.

Most pieces were unworked trimming flakes or broken scraps, some very small: five pieces were definitely worked, 226 showed signs of use and there were three small worked cores (Nos. 2032, 2041, and 2075). It was clear from the presence of cortex that some material had been brought to the site as weathered nodules and had been worked there. The principal concentration of flakes was found on the working floor in F6 extending into E6, together with a hammerstone (Fig. 20) and a stone polisher (Fig. 19).

It appears from the recorded stratified finds that the obsidian was worked and used principally during the early occupation of the settlement. It occurred consistently in the lower layers in E6 and 7 and in small numbers in the filling of Pits 1, 6 and 7. It is poorly represented in the upper occupation layers and in the filling of long Pit 8 and in the late Ruas 2 and 3 which post-date the defences. There were only two pieces in the filling of the large external Pit 10.

Lower occupation layers	565
Early pits filling	7
Upper occupation layers	73
Late pits and *rua* filling	16

Animal bones

These were examined by Diane Foley (Mrs Spencer): they were all from hares *(Lepus capensis)* or rabbits *(Oryctolagus cuniculus)* with the exception of one radius shaft possibly from a dog *(Canis familiaris)*. The propensity of rabbits to burrow in soft sandy soils is well known to archaeologists.

Chronological summary and discussion

The excavations demonstrated that there had been several major changes in the character of occupation on the summit platform of the Maioro hilltop. The first phase was an undefended or open settlement, known only from a series of filled storage pits Nos. 6, 7 and 9, which underlie the defences and from a *rua* (Rua 1) which was beneath the House 2 or cooking shed. The small scarp along the south-east side probably relates to a terrace of this first phase, since it was covered by a slip from the defences (Fig. 7, and section Z, Fig. 8). The two imported argillite adzes (Figs. 16, 17) can probably be assigned to this early period also.

The second phase saw the beginnings of the palisaded enclosure: pits and the *rua* of the first phase were filled in and a series of large deep postholes were dug, 1.5 - 2 m apart, and up to 0.75 into the natural soil to hold the uprights of a palisade. The natural slopes around the knoll were steepened by scarping, and the soil obtained was heaped up around the base of the palisade (Sections, Fig. 8). In fact along the more vulnerable south-west end, extra soil was quarried from the foot of the scarp to make a higher bank across the ridge (Sections X and Z, Fig. 8). The entrance was probably at the north-east end.

It is likely, though it cannot be proved, that a sleeping house, House 1, was constructed at this time at the upper end of the enclosure (Fig. 11). It had a porch facing south-east, sheltered from the prevailing sea winds and there was a working floor in front of it on which many obsidian flakes, a polisher (Fig. 19), and a hammerstone (Fig. 20) were found; and a long narrow storage pit, Pit 8, along one side. On the slightly lower part of the enclosure to the south-west, a much slighter rectangular structure, House 2, was built on top of the filled-in Rua 1. It contained a *hangi* so may have been a cooking shed rather than a sleeping house. Three small roofed storage pits, Pits 1, 2 and 4, were probably in use together with a row of small store holes labelled as Ruas 4, 5, 6 on Fig. 6.

In the third phase, the defences were reconditioned and strengthened. Some palisade posts near the entrance had been burnt, suggestive of an attack but this was an isolated instance. The palisade was repaired on the same alignment and extra smaller posts inserted between the main uprights. The approach to the entrance gap was defined by external timber uprights set in shallow postholes similar to those in the new palisade. At the opposite south-west end, the palisade had been similarly reconstructed, though the new posts were inserted just in front of the old ones and linked by a shallow bedding trench (Section Y, Fig. 8 and Fig. 9). On the north-east side, the shallow posts of the new palisade were dug behind and above the earlier line: it seems likely that on this side the defence was doubled (Fig. 7). A double palisade was found on Mount Roskill in Auckland in 1961 (Fox 1980: Fig. 4, 48-9). There is no evidence that the site was abandoned at this time and it must be presumed that both "houses" continued in use. Pits 1-2 and 4 and the *rua* were filled in and replaced by Pits 3 and 5, with greater storage capacity; these were both entered by a step on the lower side and were provided with external drains. Another new feature was a *whata* or a storage rack, resting on a deeply bedded post close to the cooking house.

In the last phase, the defences were put out of action. On the south-east side, a large *rua*, Rua 3 was dug through the double palisades and on the north-west, Rua 2 and another pit were cut into the scarp from the lower enclosure (Fig 3). On the ridge to the south, the existence of the large roof of the 6 m square Pit 10, and of others in the group nearby (Fig. 3) would have blocked the view along the ridge and rendered the defences ineffectual. In the interior, the remaining pits filled gradually as the sides collapsed and roof timbers were removed; burnt rubbish was deposited on top of the accumulation in Pits 3 and 8. A shallow burial of a man aged between 26 and 32 years, close to Pit 8 at the edge of the former working floor, presumably can be assigned to this period: its presence may have rendered the summit platform *tapu*. It can be concluded that in this phase, the site as a defensive settlement was abandoned but not deserted: the people probably lived in scattered groups on the lower terraces and in the vicinity, with a communal pit store on the ridge.

Dating

At the time of going to press the dates of five samples of charcoals and one of shells submitted for radiocarbon analysis had not been received from the D.S.I.R. Nuclear Research Laboratory. Without them, it is only possible to make a general assessment of the chronology.

The significant archaeological factors are:—

1. The imported argillite adzes of 2B types (Figs. 16, 17); these are likely to date from early in the classic Maori culture, the late 15th or 16th century, though little is known about the 2B varieties which succeeded the archaic types.
2. The burial, which is stratigraphically late, is assigned by Houghton to the later prehistoric period, A.D. 1550-1800 (see above).
3. The two house structures within the enclosure show little sign of alteration and relate to a single plan (Fig. 11). This suggests a relatively short period of occupation, say 100 years or four or five generations of a chiefly family. During this time the palisades were reconstructed and strengthened once.
4. Four phases of pit construction have been detected, one preceding the palisaded enclosure and one post-dating it. This suggests that the occupation of the Maioro ridge was prolonged and remained the territory of one kin-group of the Ngati Kahukoka, probably from the sixteenth century onwards. The absence of any European artefacts indicates that the site was not occupied in the early nineteenth century.

Conclusion

The 1966 excavations were successful in producing for the first time in New Zealand archaeology a coherent plan for the layout of a summit platform *(tihi)* (Fig. 11). Admittedly the area is a small one, 18 x 12 m, and the plan may not be applicable to a large and strongly fortified pa; nevertheless it has important social implications. The two small house structures indicate that it was normally occupied by a family group, probably the chief man and his dependants. The superior dwelling with its porch and centre posts was in the upper part of the enclosure, in a position commanding a view of the entrance through the palisade. In front of it there was a space used at some time for a working floor for obsidian, indicating the presence of a craftsman, as does the chisel or small adze (Fig. 18) found close by. The long narrow Pit 8 alongside the house is an unusual type with a maximum capacity of 517 cubic feet (14.6 m^3); pits of similar form at Kauri Point open settlement (Green 1963), and elsewhere, have been tentatively identified as a store for a ceremonial feast (Law n.d.). All these factors support the notion that this was a chief's house, a *rangatira* of the Ngati Kahukoka. The other smaller and slighter structure, perhaps of lean-to construction, has been tentatively identified as a cook-house; it was placed a little lower down the slope and in proximity to two kumara store pits of normal size. It could also have been used as a sleeping house for women or slaves, and as a domestic activity area.

Allowing 5 or 6 adults per dwelling (Fox 1976:24-5) it can be estimated that not more than 10 to 12 people lived on the summit platform. Others, presumably of lesser social standing, would have had their houses in the outer enclosure where there are 5 or 6 pits. Allowing two pits per family by analogy with the interior layout, two or possibly three more households can be deduced, making a total adult population of 20 to 30 in all at Maioro. This would be sufficient to scarp the whole enclosure and to cut and build the palisade in a reasonable time. It would not, however, provide enough men to defend the perimeter in case of an attack and in an emergency, assistance might be obtained from the other nearby open settlements (N51/65 and 88; Fig. 2).

Acknowledgements. In the preparation of this report, the writer has had expert assistance from several specialists. Dr Philip Houghton of the Otago University Medical School examined and reported on the human bones and Dr G.E. Orbell of the Northern Soil Survey, D.S.I.R. reported on the soils. Thanks are due to Diane Foley for the identification of the animal bones; to Bruce McFadgen for examining the obsidian; to Kathy Prickett for help with the adzes and to Dr K. Rodgers of the Geology Department, University of Auckland for identifying the other stone material. Earlier illustrations and some analysis of artefacts were undertaken by a research assistant funded by the University of Hawaii, in Honolulu. Radiocarbon dates will be provided by D.S.I.R. Nuclear Research Laboratory, Lower Hutt, through the New Zealand Archaeological Association's scheme and Mr Garry Law and published later. We are very grateful to them all for their co-operation.

The task of Fox's field survey of sites in the Maioro locality (Fig. 2) was greatly assisted by Steve Edson's expert examination of the relevant air photographs. She must thank the owner Mr C. Thompson and several other land owners who allowed her to visit the sites on their land. The records have been placed in the New Zealand Archaeological Association's Waikato file (Filekeeper, Mr S. Edson) at the Waikato Art Museum in Hamilton.

The final form of the maps, plans and sections are the work of Caroline Phillips, draughtswoman in the Anthropology Department at Auckland University; they owe much to her skill and intelligence.

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INVESTIGATIONS AT ROCK SHELTER N93/5 WAIHORA BAY, TAUPO, NEW ZEALAND

T. HOSKING* AND A. LEAHY**

*TAUPO **AUCKLAND

Abstract. Excavations in a small rock shelter at Waihora Bay, Taupo, in 1956, established four occupation layers. Artefacts included adzes, stone flakes, pumice bowls and net floats, bone tools and broken combs.

Comparison with material from the site at Whakamoenga Cave, some 20 km to the east, shows similarities between the occupation 2 period at Whakamoenga and that of the rock shelter, suggesting a date of between the seventeenth and late eighteenth century.

During a trip to the Western Bay area of Lake Taupo in December, 1956, Trevor Hosking visited a rock shelter at the eastern end of Waihora Bay (Figs. 1, 2). The site consists of a small rock overhang approximately 100 metres from the beach along the cliff which forms the eastern end of the bay. The surface of the shelter is three metres above the present lake level and is protected by the overhang. The floor was found to be dry and covered with *ca*. 5 cm of firm pumice dust.

A search of the pumice floor produced several artefacts partially covered with dust and, because of this, the site was further investigated. The layers were removed one by one and, when well-preserved or interesting artefacts were discovered, notes were made. Items such as stone and obsidian flakes were not recorded individually but gathered in one collection and their presence noted in the site. Records of the excavation, together with some of the cultural material, were sent to Dr. Gilbert Archey at the Auckland Institute and Museum. The remainder of the artefacts were retained by Hosking.

This report describes the investigation and the material recovered from the shelter. The results are compared with those from the excavation of the larger Whakamoenga Cave, N94/7, (Leahy 1976) some twenty kilometres to the east of Waihora Bay.

Items held by the Auckland Museum are referred to by their numbers in the Archaeology Department catalogue (A.R. numbers). Other items are noted by their Hosking artefact collection number.

Geology

Waihora Bay is south of the active fault associated with the Whangamata, Whakaipo and Tapuaeharuru peninsulas (for a more detailed description of the general area see the report on Whakamoenga Cave by Leahy 1976). The bay has a shingle beach and a stream which, at present, flows into the lake at the eastern end. This stream cuts its way down through the eroded pumice plain behind and to the north of the bay. The sides of the bay are bordered by high ignimbrite cliffs which once formed part of the Western Bay caldera

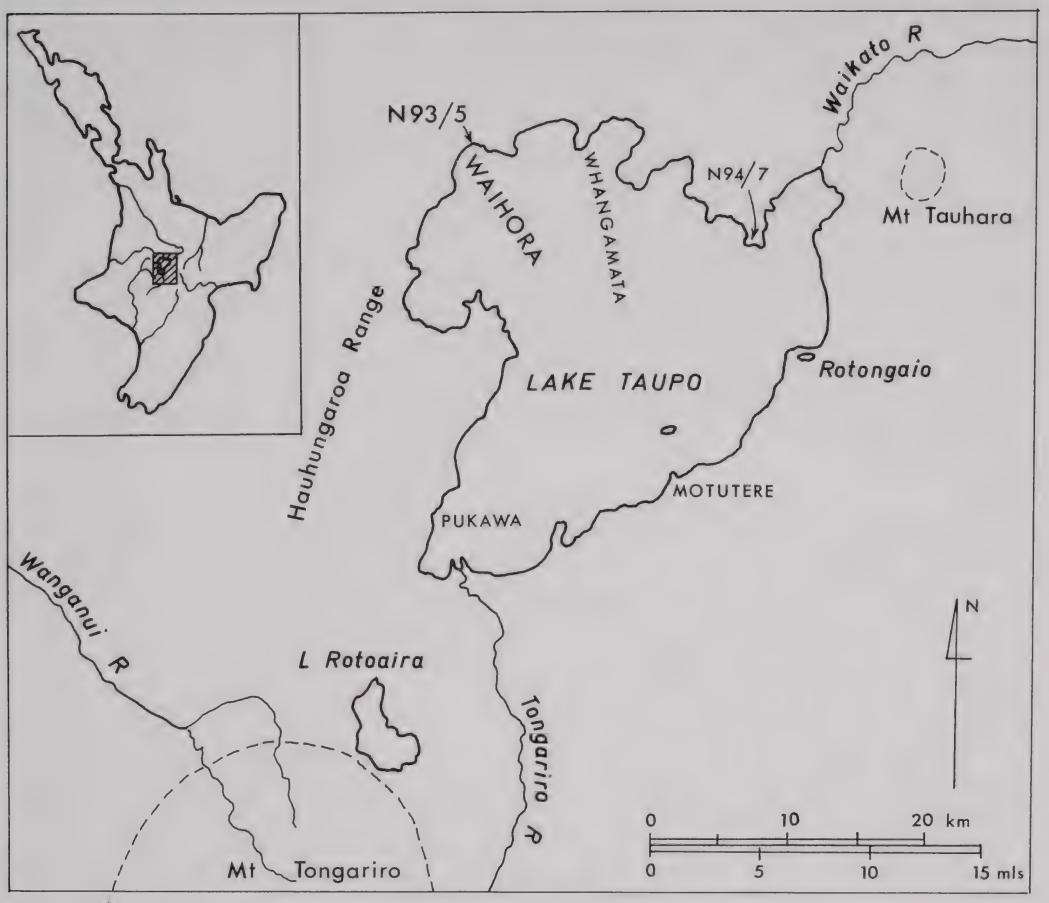


Fig. 1. Map of Lake Taupo area.

after a collapse following an eruption of magma. The rock shelter may have been formed by the undercutting of the cliff when the lake level was once higher. To the east of the overhang is a steep narrow gully with a dry watercourse which curves around the front of the shelter (Fig. 3). Protecting the site from the southern aspect of the lake is an irregular tumble of large rocks deposited in front of the shelter by the collapse of part of the roof after the lake receded.

Site Description

The site consists of a flat floor with a concave rear wall curving up to the high overhanging roof (Fig. 4). The back of the shelter is slightly undercut and contains three small recesses, a western, a central and an eastern one (Fig. 5). The floor is approximately 7 m at its widest point and 15 m long. The dry watercourse, which lies along the front of the shelter, and divides the flat floor from the rock pile and the lake, is *ca.* 40 cm deep and 1 m wide. At present there are a few scattered trees growing amongst the rocks.

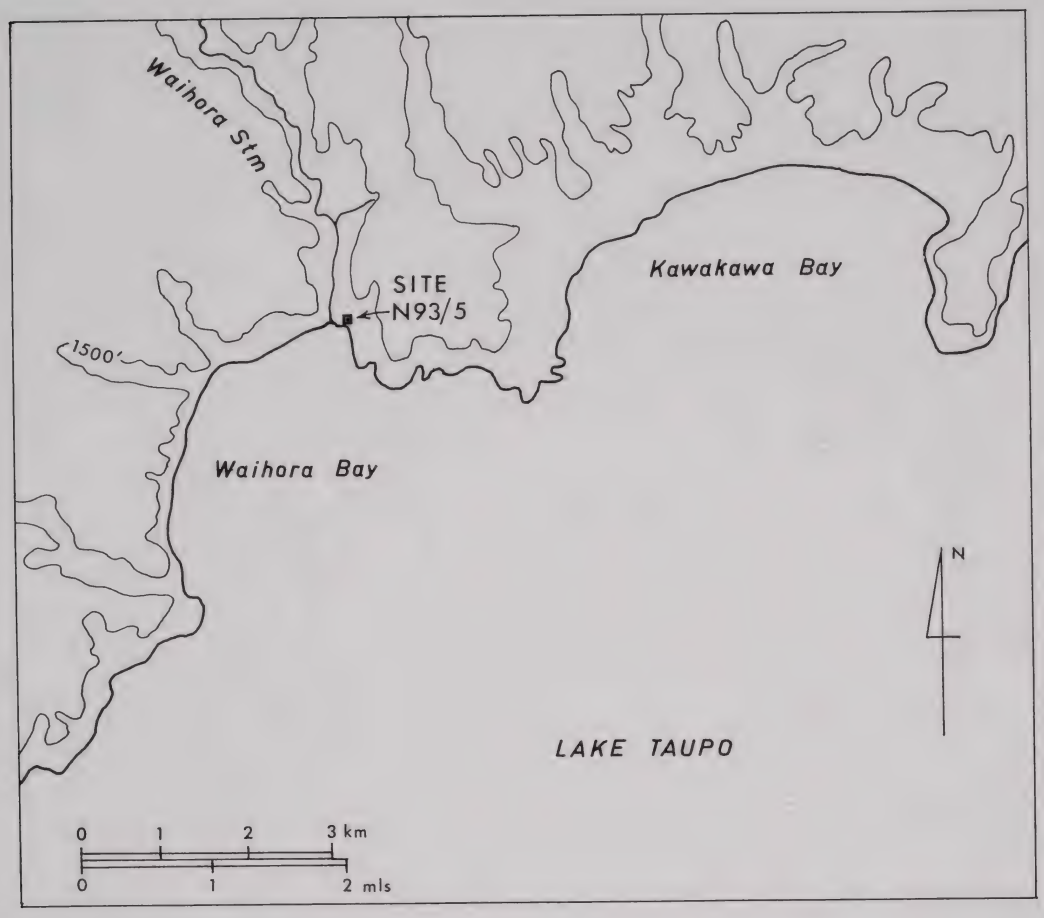


Fig. 2. Map of Rock shelter site N93/5 and surroundings.

STRATIGRAPHY AND OCCUPATION SEQUENCE

The stratigraphy consisted of five upper layers all containing cultural material, except for layer 2, and three deeper, water-deposited sterile layers (Fig. 6). The occupation layers went to a depth of *ca.* 38 cm and the sterile layers continued down for another 35 cm to the ignimbrite rock floor.

Obsidian, stone flakes and gourd pieces are recorded as being found in all layers except sterile layer 2.

The top layer, layer 5, was composed of *ca.* 5 cm of firm rhyolite dust formed by weathering of the overhang and wind-blown debris deposited naturally on top of layer 4. Cultural material occurred within it. Amongst the objects found were broken combs and a cut lock of hair as well as bone toggles, woven material, gourds, lake and marine shells, pumice artefacts, obsidian and chipped stone. The shelter may also have been used during this period for the deposition or drying out of bodies, which were subsequently removed, or as a repository for tapu items.

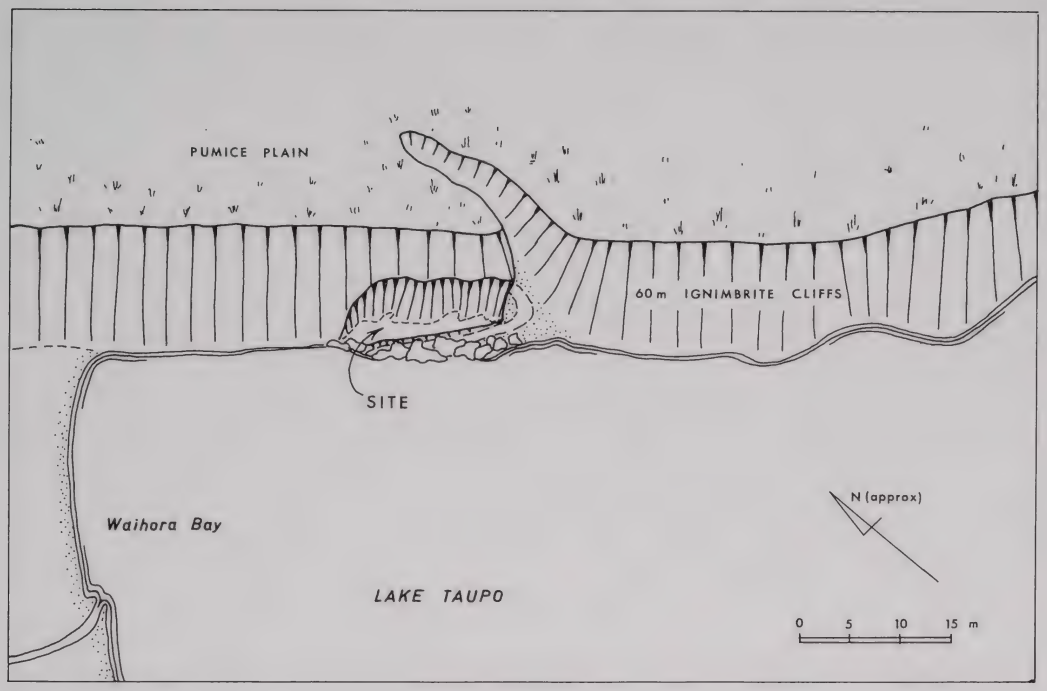


Fig. 3. Sketch of site N93/5 (after Hosking's original drawing).

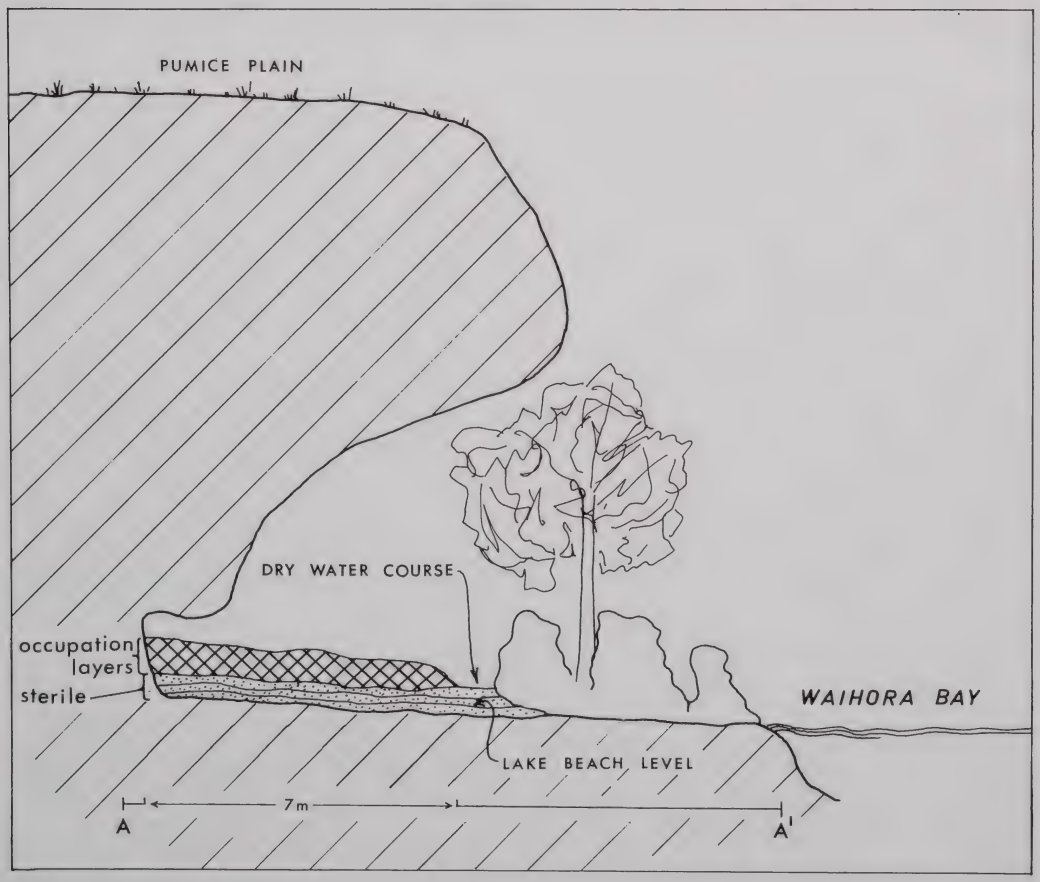


Fig. 4. Cross-section of N93/5 (after Hosking's original drawing).

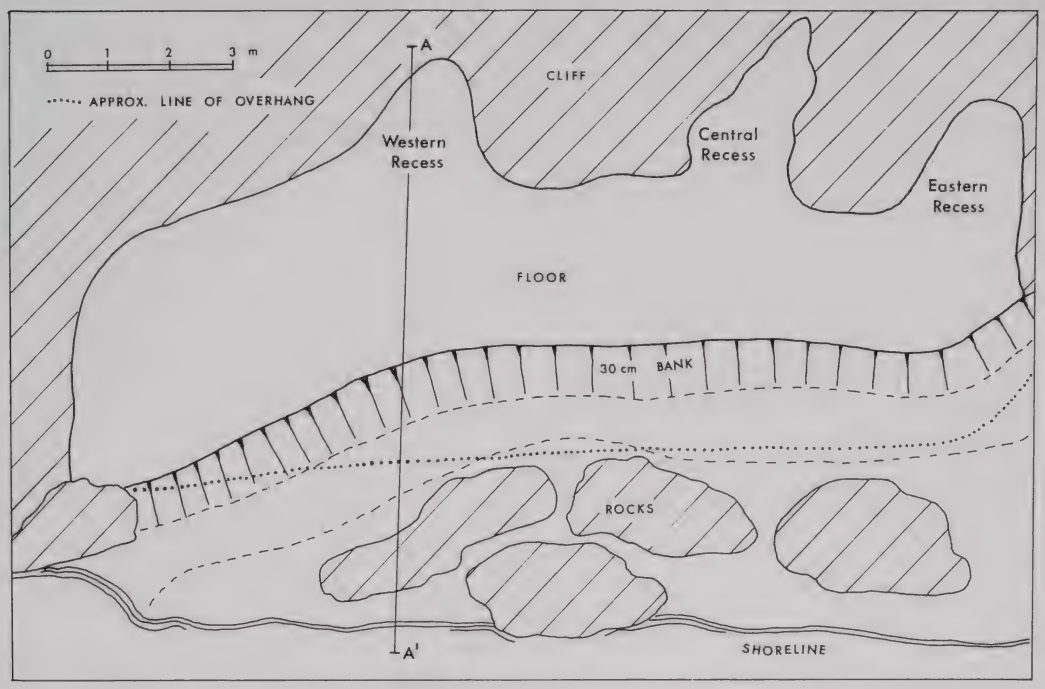


Fig. 5. Rock shelter floor plan (after Hosking's original drawing).

Layer 4, below the surface dust, was *ca.* 15 cm in depth, well compacted and contained an accumulation of charcoal, obsidian and stone flakes, broken gourds, shells and most of the faunal remains. Animals represented were dog, rat and bird. In the central recess was a carefully placed collection of dog jaw bones and teeth together with dog vertebrae (some charred) and bird and rat bone mixed with charcoal. In the eastern recess a large number of hangi stones were stacked. A small adze and an adze roughout formed from an elongated natural stone were also found.

Layer 3 was a 5 cm layer of black material with a highly compacted surface. It had the appearance of having been burnt and fires lit upon it. Nothing specific was noted from this layer (most items are recorded as coming from the two upper layers, 5 and 4). From a sketch of the floor plan it is possible that bird and rat bone came from layer 3 but some of these small animal bones may have been deposited by birds of prey, such as moreporks, or as the result of natural causes.

Layer 2 was a firm yellow rhyolite dust layer, 2.5 cm thick. It was sterile, containing no occupational material.

Layer 1 consisted of 5 cm of compacted black earth mixed with wood ash. Within this layer, at a depth of *ca.* 30 cm below the surface, a large adze was found.

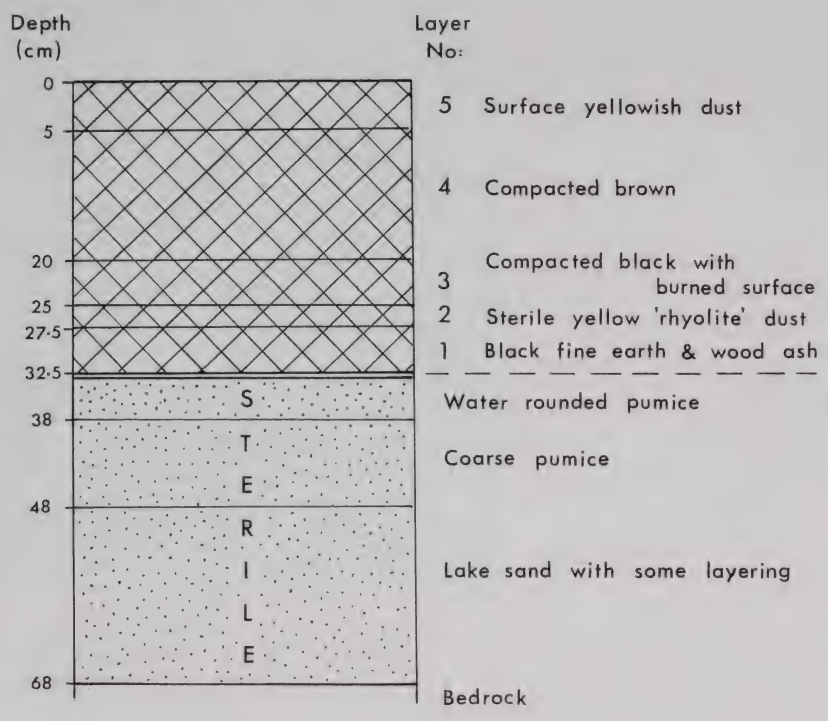


Fig. 6. Schematic representation of layers, N93/5.

Beneath these cultural layers were three levels of sterile deposits consisting of a 5 cm layer of small water-rounded pumice rubble under layer 1, *ca.* 10 cm of coarse water-rolled pumice lumps beneath that and finally lake gravel and sand containing some water-deposited layering, resting on bedrock.

Bone and Shell

A few bones and bone fragments were found. Some had been fashioned into artefacts.

Although there were bone artefacts in layer 5 there was no evidence for midden refuse. Layer 4 produced a variety of skeletal material including the remains of at least three sub-adult dogs *(Canis familiaris)*, rats *(Rattus exulans)* and birds. Many of these bones, including those of the dogs, were charred.

Some of the dog long bones were being worked in the shelter. A left radii had had the proximal end cut and then snapped off and one right radii had two nicks cut into the bone below the joint. One piece (Artefact 91) discussed later, is a small long bone with the articulating ends cut off. It could be from a sub-adult dog (I.W.G. Smith, pers.comm.).

The bird remains include some very fragile broken bones of a takahe (*Notornis mantelli*), assorted duck bones and a number of unidentified birds, many of them small (R.J. Scarlett, pers.comm.). Scarlett states that he has never seen remains of the takahe

associated with 'Classic Maori' material. The bird is known in the North Island only by sub-fossil evidence, though it may have survived until the nineteenth century (Falla et al. 1979:102). These takahe bones could have been naturally deposited but, as the shelter is rather isolated, access would be difficult for a flightless bird.

Bone artefacts include cut bone, awls, toggles and bone combs. A small broken piece of bone, A.R.6140, has been noted by Scarlett (pers. comm.) as possibly moa bone but it is too fragmentary to be sure. It has been artificially flattened on two surfaces, is rounded down one side, and measures 20x12 cm. It appears to have been charred.

A half section of the lower jaw of a tuatara *(Sphenodon punctatus)* and the jaw of a small lizard, possibly a gecko, came from the excavation. Tuatara remains were also found in Whakamoenga Cave, both in the early part of occupation 1 and in occupation 3.

Both freshwater and marine shells were present in layers 5 and 4. The few marine shells were probably imported as artefacts rather than food as none of the valves matched and most showed use wear of some kind.

Five broken left and two broken right valves of *Perna canaliculus* were found in layer 5. Also present in the site, but from no specified layer, were four valves of *Paphies* species. Three are *P. australis* (one right and two left valves) and the other a right valve of *P. (Mesodesma) subtriangulatum*.

One *Perna* valve and the *P. subtriangulatum* contain kokowai (red ochre) and one *P. australis* is thickly coated with it. All the *Paphies* species are heavily pressure flaked around the edges and had been used as scrapers.

In her study of wear damage of shells, Harsant (1978: 111) found that only one of the four *Paphies* valves from the Waihora rock shelter could be positively identified as a fern root scraper. Of the three remaining *Paphies* one was probably used in fern root scraping, another on a fibrous, woody medium and the type of material worked by the third shell is unknown. Harsant suggests that the *Perna* had most probably been used for flax or fibre preparation. A similar interpretation was advanced for *Perna* from Whakamoenga Cave (Leahy 1976: 53-54).

Ten non-matching valves of the freshwater mussel *(Hyridella menziesi)* were collected. Five of these shells are heavily coated with kokowai.

Both layers 5 and 4 contained shells but only *Perna* and *Hyridella* are specifically recorded as being present in layer 5. The *Paphies* could have come from either layer. Shells are not mentioned as being present in layers 3 and 1.

Botanical material

The botanical material in the site comprised worked wood, sticks, gourd fragments (*Lagenaria* sp.) and scraps of woven material.

Several pieces of wood show signs of working. One item, measuring 110x20 mm (A.R.6133B) has a series of fine cuts on the smooth surface where some sharp instrument, probably an obsidian flake, has been pressed along it. Another small flattened stick

measuring 170x35x5 mm (A.R.6145B) has a smooth central groove running down to where the wood ends in a charred cross-section. It could be the remains of a fire stick. A rather similar stick was found in Moa Bone Point Cave, Redcliffs, Canterbury (Trotter 1975: 210, Fig. 11). Artefact A.R.6133 is a carefully formed rectangular block of wood, 25x30 mm, smooth on the upper and lower surfaces and neatly chiselled or adzed along the edges.

Canoe travel is indicated by an oval shaped flat board (A.R.6146) with a curved base, broken across the narrow upper end and in a very fragile condition. It appears to be the blade of a small paddle and measures 250x110 mm. A rather similar flattened board may also be part of a paddle. These two wooden pieces do not seem to have been buried and so may have come from layer 5.

A piece of bracken stalk *(Pteridium aquilinum* var. *esculentum)* bent and bound with flax came from layer 5. A similar object was found in Whakamoenga Cave (Leahy 1976: 61). A split manuka twig with one kokowai covered end and a piece of cut totara bark with both sides covered with kokowai are not provenanced as to layers.

Remains of gourds were found in layers 5, 4, 3 and 1 with the greatest quantity coming from layers 5 and 4. At least two gourds are represented by their dried stalk ends which could indicate their use as cooked vegetables. There is similar evidence for the stalk end of gourds, as well as seeds, at Whakamoenga and raises the question of whether these plants could have been grown in the Taupo area in pre-European times or whether they were carried in whole from warmer areas. One large side portion of gourd (A.R.6124) is covered with red ochre on the outside and thickly encrusted on the inner concave portion. The paint, while wet, flowed over the broken edge suggesting that this piece had been a saucer-shaped container for holding or mixing kokowai. Two of the other gourd pieces are partially charred.

Several fragments of flax mats and a cloak were found. All the mat pieces are charred and no edges remain. Both diagonal and checkered weaves are represented, suggesting a minimum of two mats, at least, in use in the shelter. The small portion of charred cloak, found in layer 5, comes from the *kaupapa* or main cloak body. The warps number 8.5 to 9 per centimetre (21 warps per inch) and the wefts occur at 7 mm intervals (approximately 3 wefts per inch). The wefts are of double pair twining. Mead (1969: 52) suggests that body texture of cloaks may be gauged from the warps per inch and that a figure of 16.6w.p.i. represents a fairly coarse weave whereas the finest cloaks have a w.p.i. measure of 26 w.p.i.. On this basis the Waihora fragment would be classified as a fine 'K' type cloak and would be of much finer quality than any of the cloak remnants found in Whakamoenga Cave (Leahy 1976: 58).

Stone

There is no provenance for much of the stone and flake material. A pile of hangi stones had been placed at the back of the eastern recess and could have been associated with either layer 5 or 4, but most probably layer 4 because it also contained charcoal and faunal remains. Some stone pieces may have been the remains of exploded hangi material but a number are true flakes with bulbs of percussion. Few show obvious signs of use. Some pieces have kokowai adhering to them and a number of small lumps of prepared red ochre were found.

Several significant pieces of worked stone were present in addition to the adzes (described below) and flakes. A.R.6136B is a small oval pebble, flaked at either end and subsequently bruised and Artefact 80 is a wedge-shaped broken pebble, heavily bruised on its rounded surface. Both these are probably hammer stones. A.R.6132 is an oval kokowai-covered natural stone (11x7 cm) which has been bifacially flaked at both ends. Artefact 77 is similar but more adze-like, being bifacially flaked at one end only but with a few flakes struck from the butt end. It is rectangular in cross-section and measures 10x4.5 cm. A flake from the polished surface of an adze (A.R.6130) was also found.

Two flat unmodified pebbles, Artefacts 81 and 82, have one surface coated with kokowai, suggesting their use as grinders.

Three hundred and twenty-one obsidian flakes were found, nearly all unprovenanced. All the material is grey when held to the light except for a small 30 x 20 mm core-like piece of red obsidian, streaked with black (A.R.6137c). It shows use wear on at least two edges and was found in layer 5, as was a large grey-black banded obsidian flake knife (A.R. 6127B), 70 x 60 mm in size. It has secondary flaking on two sides and pressure flaking all round the edges.

The size of the obsidian flakes ranges from 10 to 70 mm and the total weight is 3126 gm. Smaller chips, if present, were not collected. Over 40% have some cortex evident. At least some of the obsidian was probably collected from the beaches and streams in nearby Whangamata Bay (Fig. 1). The smallish size of most flakes suggests natural pebble origin rather than quarried material (see Leahy 1976:65).

Several obsidian pieces have kokowai on their surfaces and, as a number of items known to be from layers 5 and 4 show similar staining, it is probable that all kokowai covered flakes and artefacts are from one or other of these layers. The presence of kokowai is more pronounced on items from layer 5 than layer 4 but not sufficiently so to be of use diagnostically.

A number of obsidian pieces have pressure flaking along one or more edges but they have not been analysed for use wear or source.

Water-worn pumice was present throughout the site and several modified pieces were found. Some of these had cuts and grooves of various kinds over the surfaces, while other pieces had central depressions cut to form crudely shaped bowls. One use for pumice bowls and containers in New Zealand was for carrying live coals from one place to another for instant fire making but there is no evidence to suggest the rock shelter bowls had been used for this or any other purpose. They may have been discarded items while more successful ones were taken away. One complete, finished bowl was found in layer 5 (see below). An unusual piece of pumice, Artefact 85 (Fig. 7) also from layer 5 is spirally shaped. It is 140 mm long and 50 mm wide. Its purpose is not clear but it may have been some form of shaft polisher. Other pumice artefacts are discussed below.

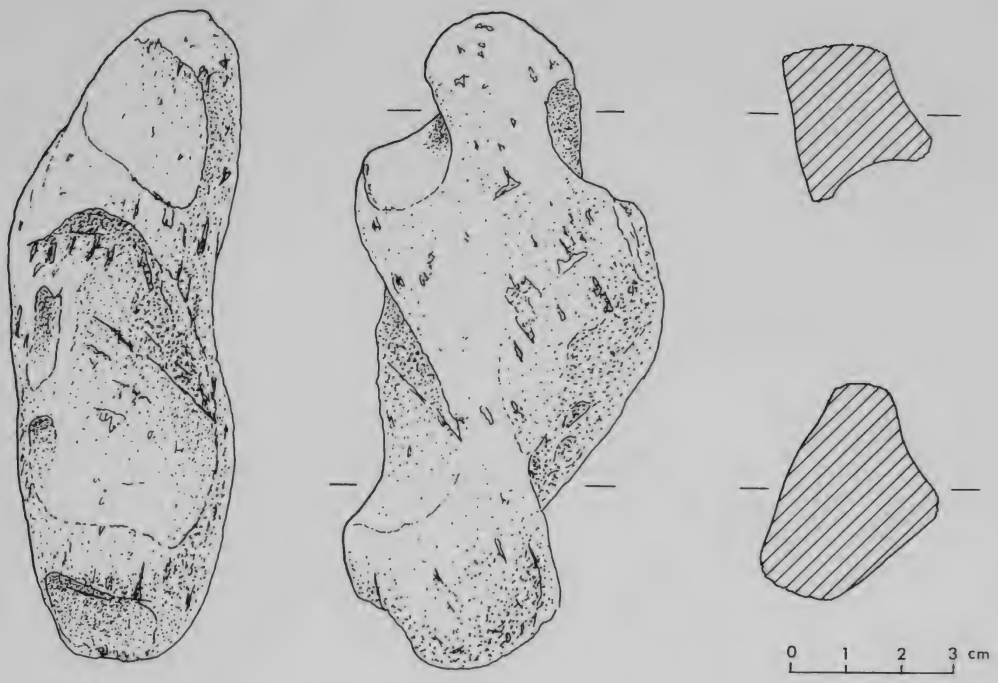


Fig. 7. Pumice artefact from layer 5.

ARTEFACTS

A number of complete or near complete artefacts came from the excavation.

Two bone toggles, Artefacts 94 and 95, are from layer 5, one found near the western recess and the other at the entrance to the central recess. The type of bone has not been identified but they are both cut from long bones. Artefact 94 is from a straight shaft section, measures 33 x 13 mm and has a hole bored through to the central cavity on one side. It is polished but not highly so. Artefact 95 is cut from a more curved piece of bone, wider at one end than the other and with the cord hole at the side but placed off centre. It is 30 mm long, 14 mm wide at one end and 10 mm at the other. This narrow end has a number of small decorative notches cut around the outer edge and the toggle is highly polished.

Bone Artefacts 91, 92 and 93 are unprovenanced although, from a rough sketch of the excavation, it is possible that Artefacts 92 and 93, at least, may have come from the deepest part of layer 4, i.e. *ca.* 15 cm from the surface. Artefact 91, already mentioned as possibly from a sub-adult dog long bone, measures 50 x 10 mm and at one end a deep notch has been cut. If it is from one of the dogs, it could have been made in the shelter and then left behind as no longer useful.

Artefact 92 is a narrow bird bone shaft, snapped at both ends, one of which has been smoothed to form a blunt point. Artefact 93, an awl, has been made from a larger bird long bone. The top has been sawn across and the lower portion broken leaving a sharp splinter which has been shaped to a fine smooth point. It has been extensively gnawed by

rats and on one side the teeth marks penetrate through to the central cavity. The awl measures 45 mm in length and is slightly shorter than Artefact 92. Both these items could have been made from bird bone remains in the shelter.

Three interesting pieces of worked pumice were excavated. Artefact 84 (Fig. 8), a pumice bowl, measuring 60 x 45 x 35 mm, came from layer 5 at the entrance to the eastern recess. Carved on one side is a double spiral. Although numerous pumice bowls in various stages of preparation were found throughout the rock shelter and Whakamoenga Cave layers, no other bowl as well finished or as elaborately decorated as this one occurred. Two pumice 'net floats', both measuring approximately 150 x 90 mm, came from unknown positions. They are similar to those found in Whakamoenga Cave except that one, A.R.6135, has a face carved on one surface (Fig. 9) and there is a cord impression encompassing the flattened sides. The other float, A.R. 6141A, has two holes bored through it and a cord line impression cutting across one side between the two holes, but the line ends before reaching the other side.

An unusually shaped item, Artefact 83 from layer 5, is a tubular, right-angled piece of soft stone with holes bored in each end. It closely resembles the upper portion of a small flute or *nguru* (Fig. 10). The bore holes are artificially made, as they taper inwards. The upper hole does not connect with the lower one which, because of incorrect angling of the drill, has penetrated the outer wall on one side. The back stop does not reach through to the upper bore hole and there is an incipient stop hole on one side below the penetrated outer wall. This position for a stop is unusual as they are generally placed on the upper part of the flute body. The base end has been broken off.

Two adzes were found. Artefact 78 (Fig. 11) came from layer 4, *ca.* 15 cm below the surface. It was situated at the back of the western recess in association with rat and bird bone. It is a 2B type, almost completely ground except at the butt end. The surface appears to have been partly hammer dressed before grinding. It is 130 mm long and 50 mm wide at the blade end and is rectangular in cross-section. The bevel has been ground

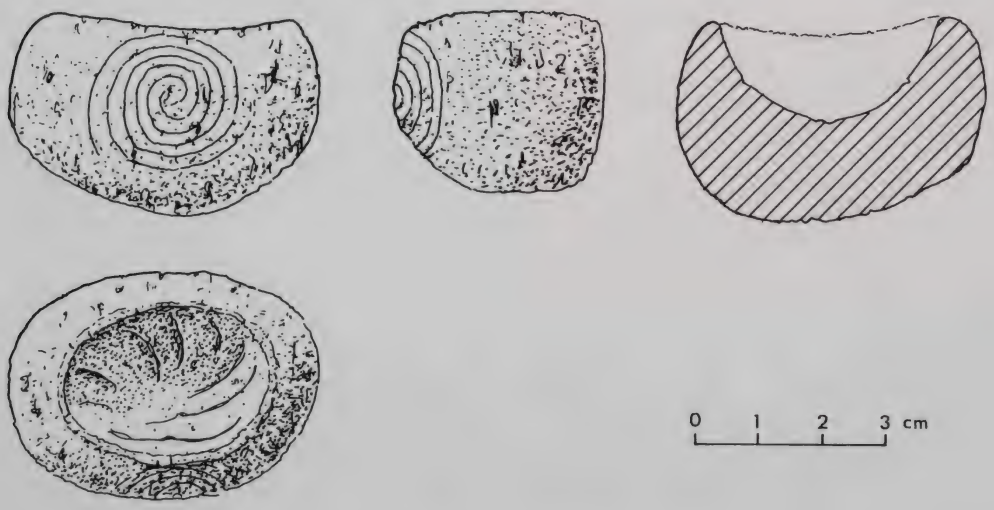
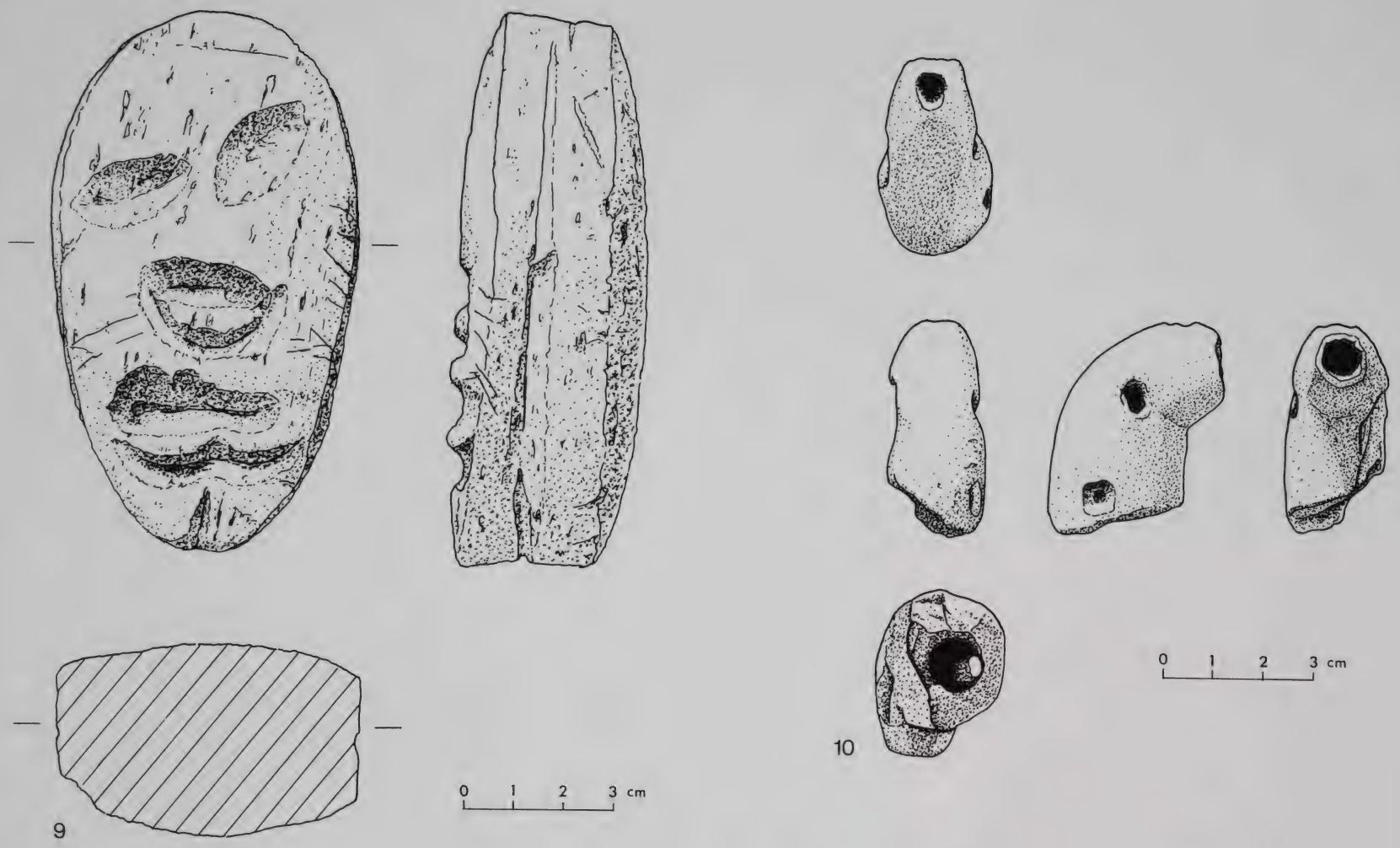
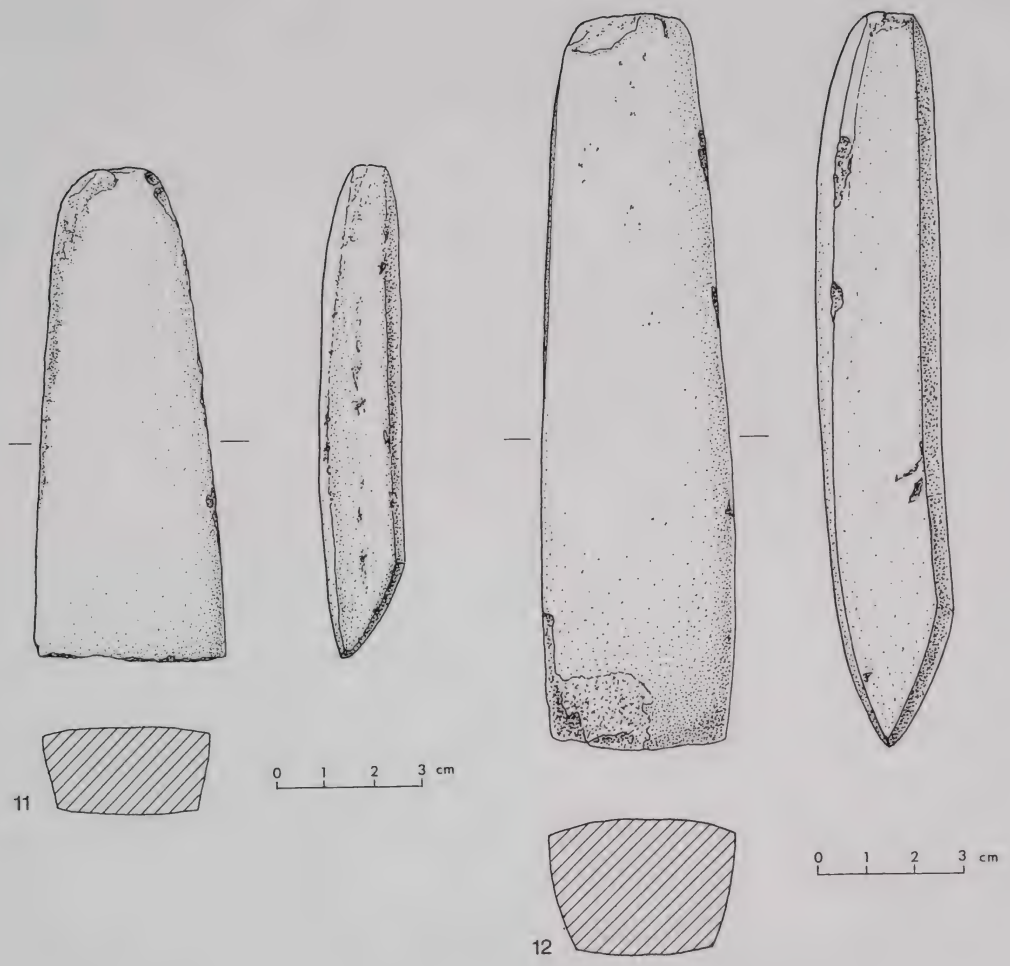


Fig. 8. Decorated pumice bowl from layer 5.



Figs. 9, 10. 9. Pumice artefact. 10. Broken stone artefact with artificially bored holes, possibly a small flute.



Figs. 11, 12. 11. Adze from layer 4. 12. Adze from layer 1.

but the blade end subsequently hammer-dressed and slightly reworked without re-grinding. There is a small chip out of the cutting edge and a few kokowai flecks on the surfaces.

Artefact 79 (Fig. 12) is a large adze found in the centre of the shelter at a depth of 30 cm in layer 1, associated with burnt wood ash and charcoal. It measures 195 x 55 mm and is a 2B type with a rectangular to squarish cross-section and a slightly curved longitudinal section. It is almost entirely ground except at the butt end. There is a chip out of the cutting edge on both sides of the bevel and it is possible that some attempt has been made to modify the damaged edge by hammer dressing on the front bevel surface. A small (85 x 20 mm) model pumice adze from the earliest occupation in Whakamoenga Cave is rather similar to Artefact 79 in that it is like a 2B, squarish in cross-section and slightly curved in longitudinal-section although 'stubbier' in appearance (Leahy 1976:64).

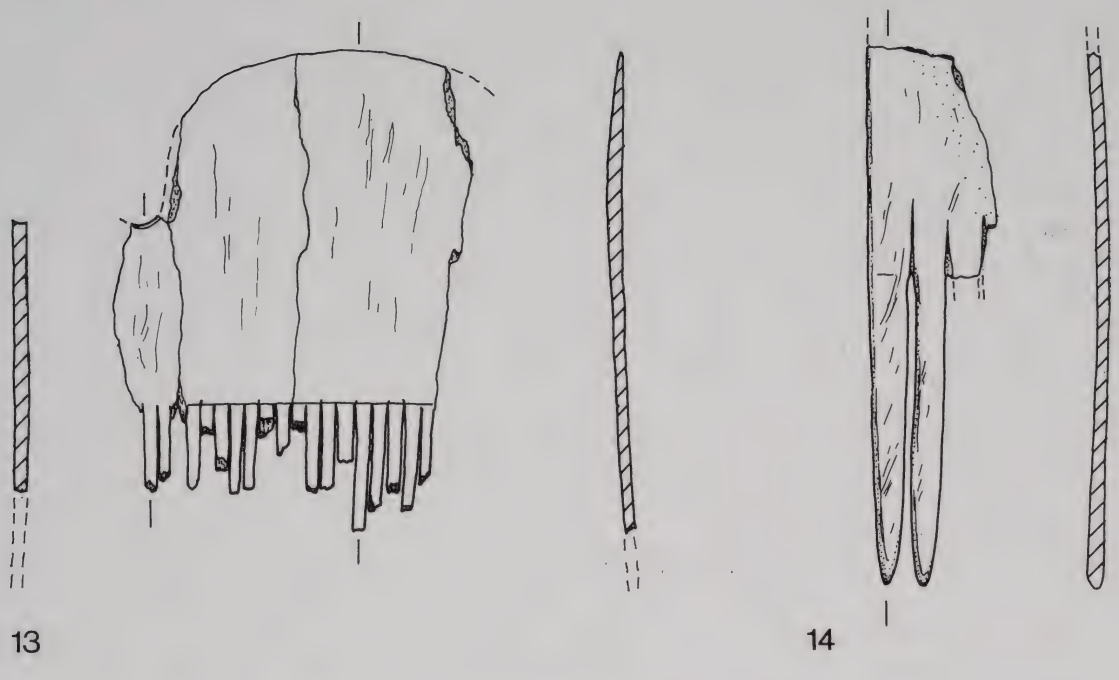
Three main types of hair combs occur in New Zealand, namely bone one piece (usually of whale bone), wooden one piece and composite wooden ones. Only two types are represented in the Waihora rock shelter. These are whale bone one piece and the composite wooden types. All came from the surface layer 5 and all were broken, probably deliberately, and left in the shelter.

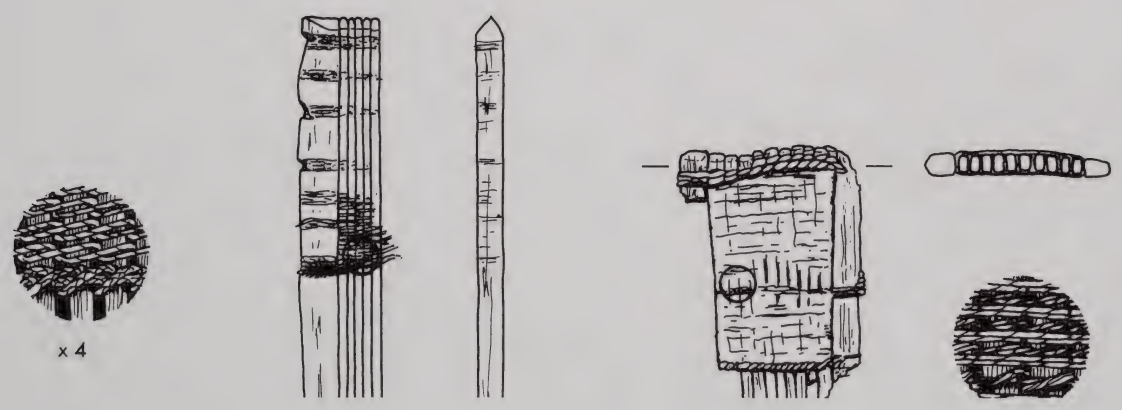
The most complete of the two bone combs is A.R. 6125 (Fig. 13). It is broken into three parts down the grain and the teeth are snapped off *ca.* 20 mm below the frame base. A few squarish broken teeth from it were recovered. The curved frame top is undecorated and drops down on one side to what may have been a side notch or decoration, but both outer edges are missing. The remains of 18 teeth are present and there is a marked horizontal line dividing the base of the frame from the teeth. The teeth are squarish in cross-section and the interstices between them is very narrow. From this it might be inferred that some kind of fine European sawing tool may have been used to make the comb. However some teeth have uneven sides, indicating that they have been separated by cutting from both surfaces and this could have been done using obsidian. The comb is in a fragile condition.

Comb A.R. 6126 (Fig. 14) is a piece of polished whale bone which has been broken across and down the frame. Part of the frame edge, two complete teeth and the base of a third, is all that remains. The teeth are 55 mm long, 6 mm wide and approximately 2 mm thick where they meet the frame. They thicken to 3 mm at their tips giving them a slightly globular appearance. The tooth intersticies have narrow but clear gaps between them and the edges are smoothed round. There is no horizontal demarcation line between the teeth and the frame base. The comb is slightly stained with kokowai and is in better condition than A.R. 6125.

Little remains of the composite combs found. Composite combs consist of a number of long, thin, uniform slivers of wood bound or woven together across the upper portion with fine cord forming a frame from which the free teeth project. The two outer or framing teeth are more substantial in form, keeping the inner teeth rigid and acting as 'strainers' for the inner binding.

Composite comb A.R. 6123 (Fig. 15) is in a very fragile condition because of the distintegration of the cord binding. The comb consists of five teeth held in position against a larger framing tooth by very fine twisted cord. At intervals the cord extends out and crosses over and around the framing tooth. The binding is too damaged to establish the weaving pattern fully although the style is much less sophisticated than that on some other combs in collections studied. The framing tooth has been notched at regular intervals on its outer side to hold the inner teeth in place. There are also unnotched binding imprints showing around parts of the framing tooth and considerable red staining of the wood and cord suggesting it was once covered in kokowai or else worn in a head of hair impregnated with the substance. Fifteen loose inner teeth identical in length and shape to those attached to comb A.R. 6123 were found and are almost certain to be from this comb. The teeth measure 110 mm in length, taper from 5 mm in width near their tip to 4 mm at the frame end and are *ca.* 1.5 mm thick. The other framing tooth was not recovered.





Figs. 13-16. 13. Broken bone comb, layer 5. 14. Broken bone comb, layer 5. 15. Remains of a composite wooden comb, layer 5. 16. Charred remains of composite wooden comb, layer 5.

Also in a very fragile condition is comb A.R. 6124 (Fig. 16). It has been charred and only the frame portion remains although the teeth may have been broken before burning. The inner teeth have been bound together, as shown in Fig. 16, and then bound to the framing teeth by a horizontal row of coarser cord, single pair twining at the top and half way down. The upper row of coarse cord appears to have been knotted on the back of the right framing tooth and the lower row on the back of the left one. The exact pattern is not clear as the lower portion of the right framing tooth is missing. The comb has ten inner teeth and two framing teeth. The frame measures 34 x 50 mm in its present charred state and is covered with kokowai.

Four separate kokowai stained teeth were also found. These are all the same size and design representing the remains of a third composite comb, the binding of which has disintegrated.

Few combs have been found in secure archaeological contexts, apart from those from the Kauri Point Swamp site, Bay of Plenty (Shawcross 1964, 1976). Teeth from a bone comb from layer 2 at Long Beach, Otago (Leach & Hamel 1981) are from a seventeenth century deposit. Wooden one piece combs were found at Kohika, Bay of Plenty (G. Irwin, pers.comm.) but no dating is available for these yet. Pieces of shaped bone, possibly representing parts of combs also occurred at Kaukoponui, Taranaki (R. Cassels, pers. comm.) and from the early but undated layer 5 at Hot Water Beach (Leahy 1974:43). Combs from less secure contexts are those from Redcliffs, Canterbury (Trotter 1975) and Oruarangi, Thames (Fisher 1934).

The three types are represented in the New Zealand comb collection from Cook's voyages indicating that they are all of pre-European origin (Kaeppler 1978).

Although no one piece wooden combs were found in the rock shelter they are known ethnographically from the Lake Taupo area and examples of these are held in the Auckland Institute and Museum (Boucher Collection) and in the O'Kain's Museum, Banks Peninsula (M. Thacker, pers.comm.). The Taupo one piece wooden combs consist of a solid wooden frame with a number of inner teeth and two wider outer framing teeth, probably developed to strengthen and support the weaker inner ones and the whole comb generally. The combs from Kohika are similar to the Taupo ones. Both these differ from the Kauri Point swamp combs in that the swamp ones have no framing teeth, all the teeth being of approximately equal width. Green (1978: 39) suggests that the depositing of combs at Kauri Point commenced about 1500 A.D. and continued for about 200 years, ending before the eighteenth century. The wooden combs with framing teeth may be a regional varient on the Kauri Point type or a later development.

Combs are not known archaeologically nor ethnographically in other parts of Eastern Polynesia so that their origin in New Zealand is somewhat of a mystery. They are present in their composite wooden form in ethnographical collections from Western Polynesia but there are few indications of Western Polynesian influence in pre-European New Zealand. It therefore seems likely, from the evidence to date, that hair combs were an indigenous development.

It is not known when the use of combs finally died out although it has been suggested that missionary influence and the European fashion of short hair for men from about 1815

onwards caused this cultural tradition to cease. It probably happened at different times in various parts of New Zealand.

It seems likely from the comb evidence that the rock shelter was last occupied at some time before the late 1820's and, as there is no evidence for the presence of European artefacts, use of the shelter could have ceased at a considerably earlier period.

CONCLUSION

The remains from the rock shelter at Waihora Bay suggests periodic visits by small groups of people over an unknown period of time.

There are many general similarities between the rock shelter and the larger Whakamoenga Cave further east. The Waihora evidence most closely resembles that from occupation 2 at Whakamoenga, suggesting that the shelter was probably in use from the seventeenth to the late eighteenth century. It was abandoned in pre-European or possibly early European times. Cultural material from the rock shelter is much more restricted than that from Whakamoenga but from the excavated evidence, though much of it was unprovenanced, certain inferences about the activities of the occupants can be made.

Of the vegetable material found, the use of gourds both as food and as containers is indicated. Fern root was prepared and eaten and bracken and flax used in the preparation of artefacts of unknown use. Raw flax was worked in two different weaves to form mats. These were probably for use in a hangi as the pieces were burnt but they could have been the remains of sleeping or wrapping mats. At one period a fire stick was used to light fires.

A limited range of birds was carried in as food, amongst them ducks and a takahe. As in occupation 2 at Whakamoenga, little bone material from bush birds was identified in the shelter suggesting that, by the seventeenth century, most of the surrounding bush had been destroyed by fire (see Leahy 1976:32-33; 68). Some of the bird bones may have been formed into awls or points, used and subsequently discarded. Three sub-adult dogs were killed and consumed during the layer 4 occupation. Attempts at working some of the dog long bones occurred and one artefact of unknown use was found. As not all the long bones are accounted for it may be that some dog haunches or the bones were taken away for use elsewhere (see Smith, 1981). Other food items may have included a tuatara, a gecko, native rats and freshwater mussels.

The possible presence of a piece of worked green or semi-fossil moa bone is interesting as it would indicate that the shelter was occupied at a time when men still had a knowledge of the use of moa bone. If so, it is likely that the piece could have come from layer 1.

Access to the shelter would have been easier by canoe than by land and the remains of what appear to be paddles suggest this. Much of the stone was brought in, most likely by canoe, and flaked on the spot as required or used as hangi stones. Some of the obsidian had the cortex removed, possibly to form more manageable pieces for transportation elsewhere.

The presence of two finished adzes and the flake from a third indicated that wood working was one of the activities of the occupants. The small block of wood may well have been prepared for some piece of equipment but finally discarded. The fact that two adzes were left behind at different periods suggests that these items were expendable, easily replaced or left in the shelter for an anticipated future visit.

Pumice was extensively used in the Taupo area and, as has been suggested for Whakamoenga Cave, prepared pieces may have been manufactured and exported. The two net floats in the shelter closely parallel some from Whakamoenga and were probably used with nets for catching the native kokopu *(Galaxias brevipinnis)* and their juveniles or 'whitebait' in the Taupo streams and lake. There are no eels in the lake. Other uses for these floats could have been as buoys for marking the position of fresh water crayfish *(Paranephrops planifrons)* traps or other objects in the water. The face on one of the floats suggests magico-religious functions associated with the fishing process or its use as a *rahui* marker.

Pumice bowls, both partially formed and completed were present in the shelter. Well prepared ones, perhaps for carrying live coals in, were taken away and the rejects left behind. The complete, finely decorated bowl from layer 5 appears to be unique for the region.

The presence of the broken flute is hard to account for. It was not finished because of a fault in manufacture and was subsequently broken. Its presence, however, does indicate that such items were in use in the area and were part of the cultural and ceremonial activities of the Taupo tribes.

The fine woven cloak remains, along with other items in layer 5, may indicate that the body of a person of importance had been placed in the shelter.

Increasing activities and population growth around the lake occurred after the deposit of sterile layer 2 in the shelter as there is little evidence for an extensive time break between layers 3, 4 and 5 compared to that indicated between layers 1 and 3.

Occupations 1, 3 and 4 suggest the use of the shelter as a place for temporary habitation rather than for any specialized function. This changes during the last occupation when it probably became a place for the exposure of bodies and the deposition of associated personal objects, the bodies being later removed and the shelter abandoned before the arrival of European artefacts or influence.

Despite interpretative problems arising from lack of strict excavation control the material from the rock shelter at Waihora is of considerable interest to the prehistory of the Lake Taupo area generally and of particular significance in relation to the Whakamoenga Cave results.

Acknowledgements. Professor R.C. Green first drew our attention to the distribution anomaly of hair combs in Eastern and Western Polynesia and we are indebted to him for further helpful discussions. Janet Davidson read the manuscript and her constructive comments and encouragement over a long period of preparation was much appreciated. We would also like to thank R.J. Scarlett, Canterbury Museum, for his work in identifying the bone material and J. Goulding, Auckland Institute and Museum for the botanical and fibre identification. Mr D.R. Simmons kindly assisted with the use of material in the Auckland Museum.

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NEW AND INTERESTING RECORDS OF ADVENTIVE PLANTS FROM THE AUCKLAND INSTITUTE AND MUSEUM HERBARIUM 8

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Abstract. This eighth list of some recent additions to the Auckland Institute and Museum Herbarium (AK) and re-determinations of earlier gatherings provides new records for some adventive species and further information on the distribution of others.

In addition to material provided as in former years by various collectors, in particular by Mr A.E. Esler of D.S.I.R., Botany Division, Auckland, a number of specimens have been obtained by exchange with D.S.I.R., Botany Division, Christchurch (CHR) and the National Museum, Wellington (WELT). From these sources voucher specimens for new records have been acquired and gaps in the AK Herbarium have been filled in.

The nomenclature adopted in this paper is that published by the New Zealand Weed and Pest Control Society (1969) except for species dealt with in volume 3 of the *Flora of New Zealand* (Healy & Edgar 1980) and in the series of checklists published in the *New Zealand Journal of Botany* from 1978 onwards by members of the D.S.I.R., Botany Division staff at Christchurch.

All specimens are cited by the AK number and, where these are provided, by the collectors' numbers. Unless otherwise stated the specimens may be regarded as the only material of the species possessed by the Herbarium and, where no previous literature is cited, as first records to the best of my knowledge at the time of writing.

RANUNCULACEAE

Ranunculus ophioglossifolius Vill.

Waitomo Co., Te Kuiti, in roadside drain, 1928, H.H. Allan, AK 12757, as *R. flammula*.

The above gathering, re-determined by Dr. Garnock-Jones, comes from Te Kuiti, one of the original localities cited by Healy (1957), the other being Kawhia. No further distribution is given in Garnock-Jones (1981).

PAPAVERACEAE

Papaver somniferum L. subsp. *somniferum*

Tuapeka Co., Roxburgh Dam, 1958, K. Wood, AK 50527; Auckland, Emily Place, 1981, A.E. Wright 3824, AK 152011.

Rec. Auckland Inst. Mus. 19: 101-108 17 December 1982

Garnock-Jones (1979) gives the first record for the opium poppy as Cheeseman (1883), where Devonport and Ponsonby are cited as localities. A note on the label of the second gathering above reads "Population has persisted in waste ground for 3 to 4 years". Since Cheeseman's time several authors (e.g. Thomson 1922, Allan 1940), have recorded the poppy but in general have remarked on its scarcity as a naturalised plant.

BRASSICACEAE

Lepidium desvauxii Thell.

South Westland, Waiho Bluff, coastal talus at foot of moraine cliffs, 1972, P. Wardle, AK 150726, (Dupl. ex CHR 218715).

The first published record for this species appears in Garnock-Jones (1979), where the distribution is given as South and Stewart Islands.

Lepidium divaricatum Ait.

Buller Co., near Westport, railway line, W. Townson 243, AK 65469-70, det. P.J. Garnock-Jones.

This gathering was previously determined by H.H. Allan as *L. virginicum*. The first published record is also to be found in Garnock-Jones (1979), where it is stated that Westport is the only known locality for this species.

CUCURBITACEAE

Cucurbita ficifolia Bouché

Auckland, Panmure, Oran Road, 1981, A.E. Esler, AK 153922.

A note with this specimen, presented by Mr Esler, states "climbing over trees in park; perpetuating itself from unharvested fruits. Malabar gourd, but known in Auckland as pie-melon". It was first recorded by Sykes (1982).

BEGONIACEAE

Begonia semperflorens Link & Otto

Auckland, Mt. Wellington lava fields, 1973, A.E. Wright 526, AK 134531.

This begonia also grew wild on One Tree Hill and Mangere Mt. according to a note with the specimen above: it is also known to Mr Esler in the Auckland area. Also first recorded by Sykes (1982).

EUPHORBIACEAE

Euphorbia maculata L.

Auckland, Auckland Railway Station, occasional in pavements, 1981, A.E. Esler, AK 153921.

This is in addition to the specimen (A.E. Wright 2053) cited in Bangerter (1978), where a Cheeseman specimen (Auckland, AK 74945) was erroneously recorded. The error arose from the fact that, as pointed out by Webb (1981), *E. nutans* was sometimes

known in New Zealand as *E. maculata;* Cheeseman's plant was under the former name. True *E. maculata* has appressed hairs on the capsules and usually purple-blotched leaves, unlike *E. nutans,* and was not recorded until 1969, as stated in Webb (1981).

Euphorbia platyphyllos L.

Auckland, Mt. Albert, railway margin, 1980, A.E. Esler, AK 153920.

Warted spurge was first recorded by Allan (1935) from "waste places about Auckland City", the same area given in Allan (1940). Webb (1981) adds Wellington to the distribution but I have traced no further records.

CAESALPINIOIDEAE

Cassia tomentosa Linn.f.

Franklin Co., north end of Wairoa Gorge, R.O. Gardner 2810, AK 153001.

The first record for this buttercup tree is in Webb (1980), where the known distribution is given.

MIMOSOIDEAE

Acacia floribunda (Vent.) Willd.

Hutt Co., by Paraparaumu Airport on roadside, 1981, G. Straka 308, AK 154352.

First recorded by Webb (1980), gossamer wattle is known from few stations and the above adds a further locality to its distribution.

PAPILIONOIDEAE

Teline linifolia (L.) Webb & Berth.

Hawkes Bay Co., Napier, Bluff Hill, coastal cliffs, 1980, C.J. Webb, AK 151624, (Dupl. ex CHR 362822).

The above locality is the only one cited in Webb (1980); the specimen was acquired by exchange with CHR. A note on the label reads "Common, naturalised at base of cliffs near wharf area, numerous seedlings well established."

Trifolium angustifolium L.

Opotiki Co., Te Kaha, Bay of Plenty, roadside, 1981, D.R. Miller, AK 153929.

Some localities in both Islands are given in Healy (1976), where the narrow-leaved clover is said to be "a rare casual". Webb (1980) gives the first record as Allan (1940) "near Auckland". Mr Esler kindly presented the specimen.

COMPOSITAE

Centaurea nigra L.

Matamata Co., Matamata, Arawa Street, waste ground, 1977, A.E. Wright 2047, AK 142912; Manukau City, Puhinui Stream, roadside on grassy strip, 1978, A.E. Esler & M.L. Scott, AK 144031.

Knapweed was listed by Kirk (1870) and Smith (1904) recorded it for Ashburton. Subsequent authors, remarking on its uncommon occurrence in general, have not cited precise localities or have merely repeated the early records.

Crepis setosa Haller f.

Auckland, Remuera, T.F. Cheeseman, AK 89881-6 (six sheets); Auckland, Mt. Hobson Road, Jan. 1945, A. Wall, AK 33820, in Herb. B. Molesworth as *Picris hieracioides?;* Feb. 1945, A. Wall, AK 91224, as *Tolpis?*

Bristly hawkbit has been recorded in New Zealand from early times; it was known to Kirk (1899) from Remuera. Its distribution in both Islands is summarised in Healy (1976). The AK Herbarium, however, has only the above gatherings, including the two formerly mis-identified specimens.

Erigeron pusillus Nutt.

Mangonui Co., Whale Island, Moturoa group off Karikari Peninsula, 1976, A.E. Wright 1164, AK 140180.

At first thought to be *E. canadensis* this specimen provides a further record for *E. pusillus* to that published by Bangerter (1977). A further reference in the literature is Healy (1954).

Xanthium pungens Wallr.

Matamata Co., Matamata, Station Road, 1981, R.F. Ward, AK 152930.

Powell (1968) listed this species are harmful, entering the country by way of seed as a horticultural item. The specimen above was presented by Mr. Esler; a note indicates that it was "growing in an asparagus crop, previously in maize, common."

LOBELIACEAE

Lobelia erinus L.

Auckland, naturalised on sea-cliffs Parnell, 1980, A.E. Esler, AK 152042; Waitemata Co., Waitakere Range, Waiatarua, 1980, J. Mackinder, AK 154846.

Armstrong (1880) first recorded this lobelia from Canterbury, repeated by subsequent authors. Its recent distribution in both Islands is to be found in Sykes (1981).

LABIATAE

Galeopsis tetrahit L.

Manukau Co., Otahuhu, naturalised, T.F. Cheeseman, AK 94384.

Although this specimen of hemp-nettle is undated, Cheeseman (1883) published the first record from Otahuhu, Jan. 1881; this was repeated by Thomson (1922) and Allan (1940). Healy (1969) listed it for Canterbury and Matthews (1975) stated "occasional in crops near Auckland". According to Sykes (1978) the known distribution remained as Auckland and Canterbury.

LILIACEAE

Aloe saponaria (Aiton) Haw.

Rodney Co., abundant on steep banks above road down to Leigh Wharf, 1981, A.E. Wright 4157, AK 154991-2.

Cheeseman (1883) first recorded this aloe as *A. latifolia* Haw., the record being repeated by Thomson (1922) and Allan (1940). A Cheeseman gathering from Remuera (AK 94788) is cited in Healy & Edgar (1980), where a description and distribution of the species are given.

Asparagus sprengeri Regel

Auckland, Tamaki Drive, large clump naturalised on water-front cliffs, 1976, A.E. Wright, AK 152026; 1980, A.E. Wright 3623, AK 152027.

A description of this species may be found in Bailey (1924). The two gatherings above indicate the occurrence of the plant for at least four years.

Kniphofia uvaria Hook.

Waitemata Co., Waitakere Range, Piha Road, roadside, 1981, J. Mackinder, AK 155015.

No previous record for this garden escape has been found and it does not appear in Healy & Edgar (1980). Bailey (1924) has a description.

Lilium formosanum A. Wallace

Waitemata Co., Waitakere Range, Scenic Drive, 1980, J. Mackinder, AK 154848.

The first record for this lily was published by Healy & Edgar (1980), including its distribution, which is limited to the North Island.

ALSTROEMERIACEAE

Alstroemeria aurantiaca D. Don

Hutt Co., Upper Hutt, Bridge Road, streamside under broom, 1979, P.J. Brownsey, AK 152742; Waitemata Co., Waitakere Range, Te Henga Road, 1980, J. Mackinder, AK 154841.

In Healy & Edgar (1980) Upper Hutt is given as the locality for the first collection of this plant and Healy (1958) as the first record. Additional notes on the label of the first gathering above state "well established group of plants at the top of a roadside bank above dumped rubbish". The second gathering extends the distribution further north than stated in Healy & Edgar (1980). Esler (1978) lists the plant for Manawatu and Adams (1980) provides an illustration.

IRIDACEAE

Babiana stricta Ker-Gawl.

Rodney Co., Whangaparaoa Peninsula, Manly, Reserve above cliff, 1980, J.H. Goulding 936, 937, AK 152034-5.

The first published record for this species is in Healy & Edgar (1980), the locality for the first collection being the Waikumete Cemetery in Auckland. Goulding specimen 936 above is noted as having deep bluish-purple flowers and 937 reddish-purple.

Ixia polystachya L.

Hokianga Co., Waipoua State Forest, Kawerua, 1978, A.E. Wright 2684, AK 145538; Rodney Co., Whangaparaoa Peninsula, Tindalls Bay, roadside, 1979, J.H. Goulding 923, 940, AK 145538, 151724.

The first published record for this species is in Healy & Edgar (1980) and the gatherings above add two localities to its distribution. The only other specimen in the AK Herbarium is from Kaihu, from where it was already known.

Lapeirousia laxa (Thunb.) N.E. Brown

Rodney Co., Whangaparaoa Peninsula, Tindalls Bay, 1980, J.H. Goulding 935, AK 152036.

A note with this specimen states "one clump near the edge of cliff"; it may therefore be regarded as growing wild. A garden specimen from the same area was recorded in Bangerter (1976). Healy & Edgar (1980) correctly attribute the first published record of a naturalised *Lapeirousia* from Parnell, Auckland, also to Bangerter (1976).

Tritonia lineata (Salisb.) Ker-Gawl.

Auckland City, Kingsland, railway margin, 1979, A.E. Esler, AK 152044.

The first record for this species is in Healy & Edgar (1980), where the first collection is stated to be from Wellington by A.J. Healy in 1945. Mr Esler presented the above specimen.

CYPERACEAE

Carex sylvatica Huds.

Taranaki, North Egmont Road, 1975, R.O. Gardner 991, AK 151343, det. E. Edgar.

Notes accompanying this gathering state "second New Zealand record" and "edge of forest; tall, loose, yellow-green tufts". Reference to Healy & Edgar (1980) shows that the first record was published in 1973 and the first collection was made in 1969 from the Wainuioru Valley.

GRAMINEAE

Digitaria violascens Link

Bay of Islands Co., Kawakawa, 1981, A.E. Esler, AK 153925.

This gathering, presented by Mr Esler, is the second in the AK Herbarium and indicates a distribution northwards from the first recorded occurrence (Bangerter 1980). Noted on the label as "locally abundant on gravel track in scrubland".

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DESCRIPTION OF A NEW SPECIES OF *Vexillum (Costellaria)* (MOLLUSCA: GASTROPODA) FROM THE WEST PACIFIC OCEAN

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Abstract. Vexillum (Costellaria)choslenae from the West Pacific Ocean is here described as a new species of the family Costellariidae.

Family COSTELLARIIDAE

Genus **Vexillum** Röding, 1798

Subgenus **Costellaria** Swainson, 1840

Costellaria Swainson, 1840, Treat. Malac. pp. 130,320. Type species by M *Mitra rigida* Swainson, 1821 = *M.semifasciata* Lamarck,1811. Recent, Indo-Pacific.

Vexillum (Costellaria) choslenae sp. n. (Figs. 1-6)

Shell up to 33.0 mm in length, fusiformly-elongate, shining, sutures very narrowly canaliculate, width 32-33% of shell-length, teleoconch of 9-10 convex whorls, protoconch incomplete on specimens examined and consisting of 2+ minute, conical whorls. Sculptured with moderately strong, angulate axial ribs, distinct on upper spire whorls, sometime becoming obsolete and irregular on the last 2-3 whorls; ribs number from 11-37 on the penultimate and from 5-17 on the body whorl, ribs often hardly discernible on last whorl which has the appearance of being smooth. Post-embryonic whorls with 5-6 spiral grooves between axial ribs, grooves fading out towards later whorls and appearing either as small pits connected by obsolete grooves or becoming obsolete altogether; spirals number from 0-8 on the penultimate and from 6-19 on the body whorl. Aperture equal in height to the spire, 49-52% of shell-length, narrow and lirate within, outer lip smooth, slightly thickened and distinctly constricted basally, columella not calloused and only with a slight glaze and 4-5 strong folds; siphonal canal straight and somewhat spout-shaped, siphonal fasciole with 6-7 flattish cords, siphonal notch almost absent. Base colour orange-brown, spire whorls ornamented with a narrow white band, body whorl with 2 such bands, white band occasionally erupting into white, longitudinally oriented blotches, white bands bordered on either side by rectangular or streaklike darker brown spots, axial ribs frequently whitish; aperture bluish-white, columella pale orange-brown, folds usually lighter in colour.

TYPE LOCALITY. Tosa, Japan, 128 m.

DISTRIBUTION. From Japan to Papua New Guinea and New Caledonia.

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Figs. 1-6 *Vexillum(Costellaria)choslenae* sp. n. 1,2. Holotype from Tosa, Japan, 128 m, AIM No. TM-1368; 30.8 mm. 3,4. Paratype from Tosa, Japan, 128 m, coll. A.Choslen No.247; 30.9 mm. 5,6. Paratype from S. of Isle of Pines, New Caledonia, AMS No. C-133281; 32.7 mm.

Holotype. In the Auckland Institute and Museum No. TM-1368, length 30.8 mm, width 10.0 mm, height of aperture 15.2 mm; small barnacle attached to upper spire whorls (Figs. 1,2).

Paratypes. No.1 from the type locality in coll. A.Choslen No.247, dimensions 30.9 x 10.0 x 15.5 mm (Figs. 3,4); paratype No.2 from S. of Isle of Pines, New Caledonia, 22°52'S & 167°35.5'E, 370 m, bottom large slabs of beach rock, in the Australian Museum, Sydney, No. C-133281, dimensions 32.7 x 10.7 x 17.0 mm (Figs. 5,6).

I have examined the first specimen of the new species several years ago in the Australian Museum, Sydney. It was collected by HMAS ''Kimbla'' in 1971, south of the Isle of Pines, New Caledonia, in 370 m, and being a solitary specimen a description has been postponed pending the discovery of additional material. Mr C. Derry recently submitted a photograph of this species for identification and kindly informed me about the existence of two specimens from Japan in the A.Choslen collection.

Ms A. Choslen purchased these specimens labelled ''*Vexillum* sp. No.2'' in 1956 through Mr S. Hashimoto from the Teramachi collection. These two specimens were supposed to have been identified by Dr Kuroda at a later date, but it is not known if the specimens have actually been seen by Dr Kuroda. One of the labels bears a tentative identification of ''*Vexillum (Costellaria)hirasei* (Kira,1962)'', but this species is a synonym of *V.(C.)acupictum* (Reeve,1844). The latter species is similar in size to *V.(C.)choslenae* but is sculptured along its entire length with numerous, thin axial riblets which are crossed by equally as numerous spiral striae, is white in colour with dark brown blotches distributed at random and also lacks the narrowly channeled sutures and spout-shaped siphonal canal. In colouring *V.(C.)choslenae* slightly resembles *V.dennisoni* (Reeve,1844) from the Philippines, but this species is a true *Vexillum* which in other respects bears little resemblance to *V.(C.)choslenae*. The species most probably lives in a coral environment since all specimens are coral encrusted and also tend to be prone to damage as evidenced by the repair-scars in every one of the specimens examined.

The new species is named for Ms A.A. Choslen, Hemet, California in recognition for her generous assistance to the Museum of Yucaipa and also for having made her specimens available for description.

Acknowledgements. I would like to thank Ms A.A. Choslen, Hemet, California, for making the specimens available to me and for supplying detailed background information, and to Mr C. Derry, La Habra, California, for having acquainted me with the existence of further specimens of the new species. To Mr I. Loch, Australian Museum, Sydney, I am grateful for facilitating the loan of the paratype from New Caledonia.

THE TAXONOMIC STATUS OF *Cronia fiscella* (GMELIN, 1791) AND *C.margariticola* (BRODERIP,1833) (GASTROPODA: MURICIDAE)

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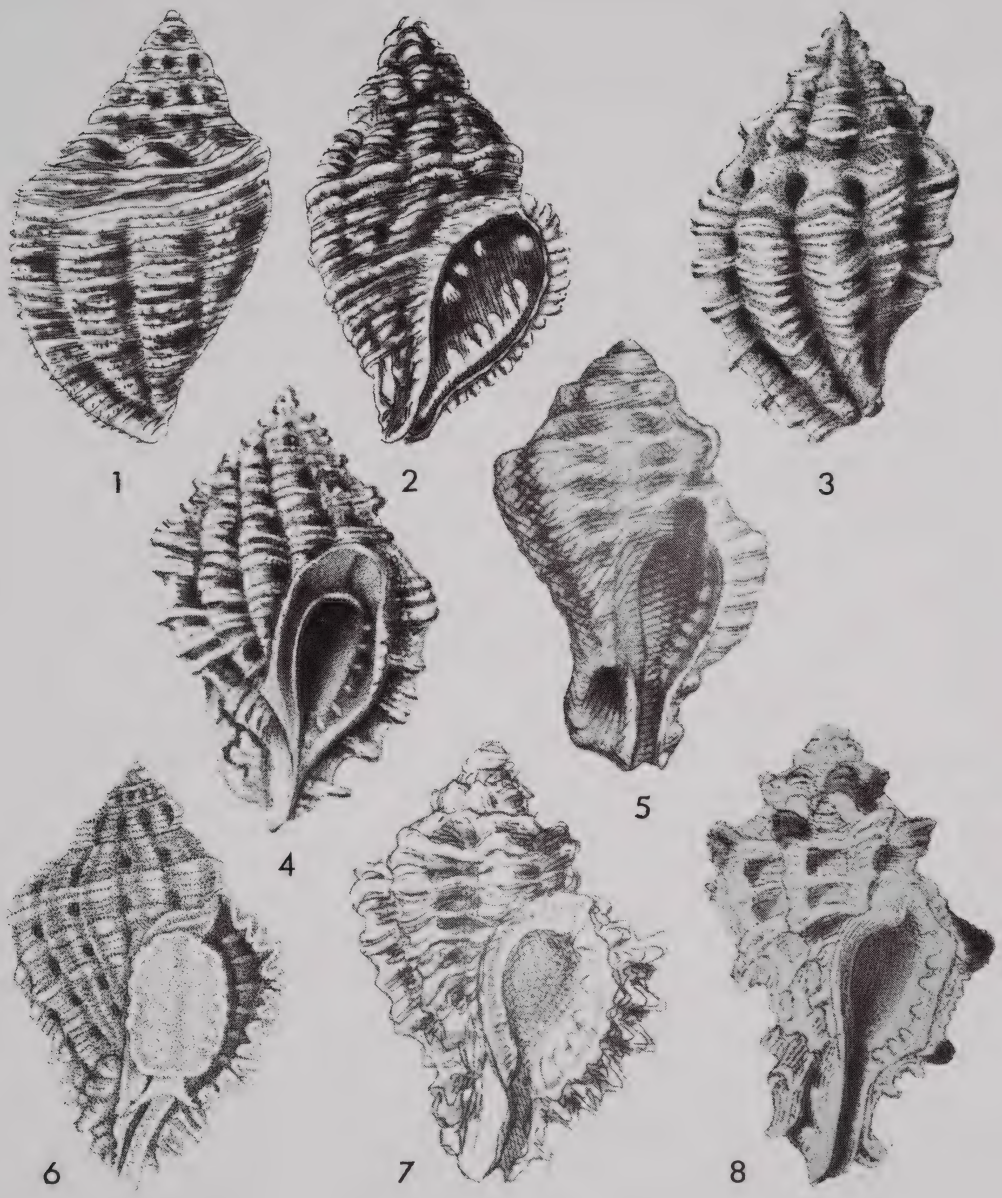
Abstract. The identity of the related muricid taxa *Cronia fiscella* (Gmelin), *C.margariticola* (Broderip) and its sub-species *crassulnata* (Hedley), is evaluated on the basis of type-specimens, type-figures, original descriptions and usage by previous authors.

In a recent paper dealing with the taxa *Cronia fiscella* (Gmelin) and *C.margariticola* (Broderip), Emerson & D'Attilio (1981) applied these two epithets to species which are different to those originally described and are contrary to current usage in malacological literature. It is taxonomically undesirable and confusing to have different names for the same taxon in literature, and a review of these taxa has been undertaken in order to arrive at a nomenclature compatible with the intentions of the original author, the history of past usage and acceptability of the majority of malacological taxonomists.

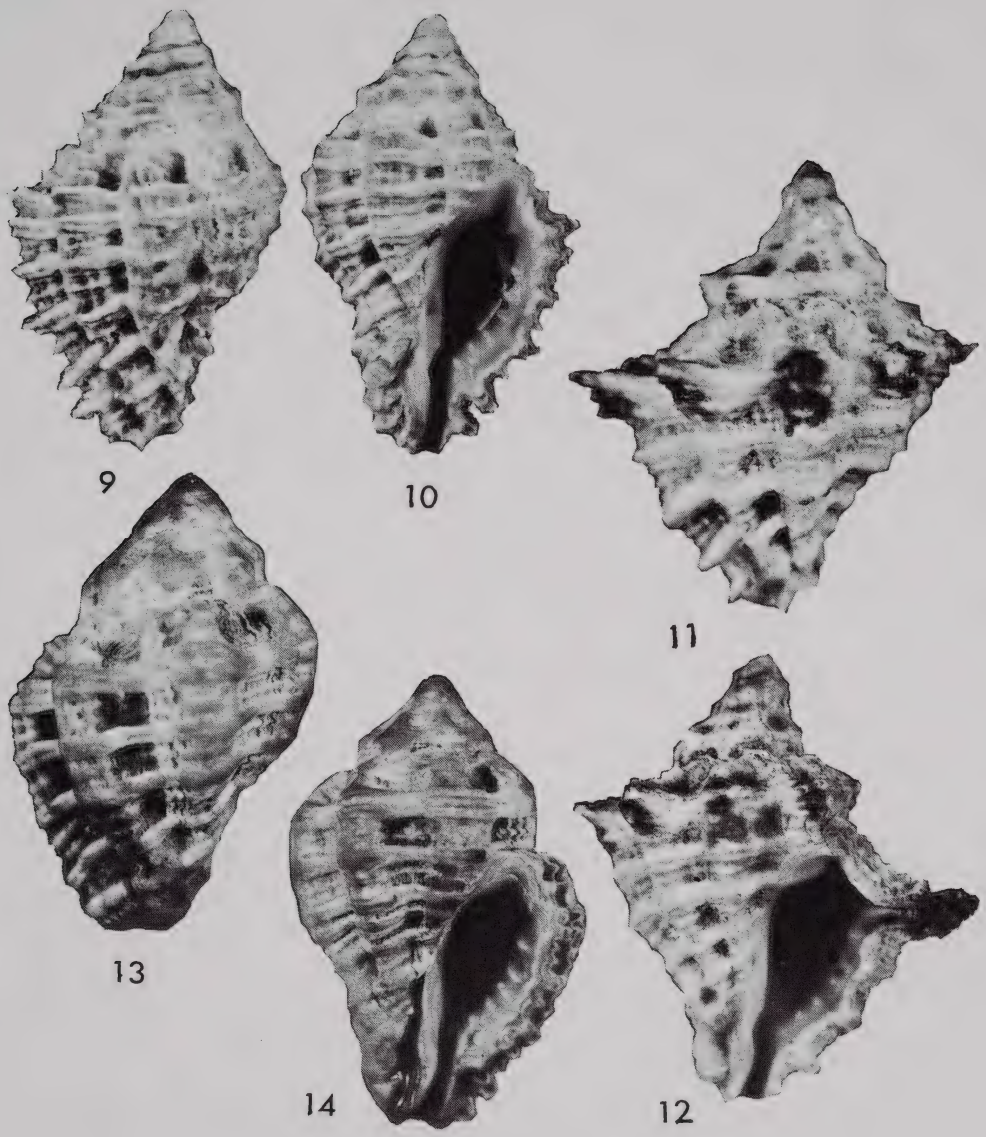
Synonymies of usage have been compiled and these are listed first, followed by a discussion on the history of the pertinent taxa and the treatment accorded to the 3 taxonomic units by past authors.

Cronia fiscella (Gmelin, 1791) (Figs. 1-14)

1788. *''Murex fiscellum''* Chemnitz, Neues syst.Conchyl.-Cab. 10:242,pl.160, figs.1524,1525 (non binom.).
1791. *Murex fiscellum* Gmelin, Syst.Nat. ed.13:3552 (ref.Chemnitz, op.cit., pl.160, figs.1524,1525).
1817. *Murex fiscellum* Dillwyn, Desc.cat.Rec.shells 2:731 (ref.Martyn,Univ. Conch.,pl.93 ?).
1822. *Purpura fiscella* Lamarck, Hist.nat.anim.s.vert. 7:246 (ref.Chemnitz, op.cit., pl.160,figs.1524,1525).
1828. *Murex funiculus* Wood, Suppl.Index Test. p.15,pl.5,fig.17.
1833. *Murex ricinuloides* Quoy & Gaimard, Voy.L'Astrolabe,Zool. 2:534,pl.36, figs.13,14 (shell); fig.15 (animal); fig.16 (operculum); 1880 Tapparone-Canefri, Ann.Soc. Malac.Belg. 15(1):22; 1901 Fischer, J.Conchyl. 49(2): 105; 1906 Dautzenberg & Fischer, J.Conchyl. 53(4):396; 1971 E.Vokes, Bull.Americ.Paleont.61(268):91.
1834. *Murex iostoma* Sowerby, Conch.Illust. pt.64:fig.42; 1971 E.Vokes, Bull. Americ.Paleont. 61(268):61.
1841. *Murex fiscellum* Sowerby, Conch.Illust., text to *Murex* (ref.to *M.iostoma* Sowerby, fig.42).
1845. *Murex fiscellum* Chemnitz, Reeve, Conch.Iconica 3:pl.27,fig.124.
1845. *Murex decussatus* Reeve, Conch.Iconica 3:pl.31,fig.153 (non Gmelin,1791).
1852. *Purpura pothuanii* Eydoux & Souleyet in Vaillant, Voy.''Bonité'',Zool. 2:605, pl.39,figs.30,31.



Figs. 1-8. *Cronia fiscella* (Gmelin). 1,2. Illustrated lectotype (from Chemnitz, 1788, figs.1524,1525). 3,4. Specimen of "*Murex fiscellum* Dillwyn" (from Martyn, 1784-86, pl.93 ?). 5. Illustrated lectotype of *Murex funiculus* Wood (from Wood, 1828, fig.17). 6. Type figure of *M.ricinuloides* Quoy & Gaimard (from Quoy & Gaimard, 1833, fig.13). 7. Illustrated lectotype of *M.iostoma* Sowerby (from Sowerby, 1834, fig.42). 8. Illustrated lectotype of *M.decussatus* Reeve (from Reeve, 1845, fig.153).



Figs. 9-14. *Cronia fiscella* (Gmelin). 9,10. Reeve's specimen of *Murex fiscellum;* BM(NH), 31.2 mm. 11,12. Holotype of *Purpura stellaris* Hombron & Jacquinot in Rousseau; MNHNP, immature spec., 15.8 mm. 13,14. Lectotype of *P.pothuanii* Eydoux & Souleyet in Vaillant; MNHNP, 19.6 mm.

1853. *Purpura muricoides* Hombron & Jacquinot in Rousseau, Voy.Pole Sud 5:87, Atlas pl.22, figs.11,12 (non Blainville,1832).
1853. *Purpura stellaris* Hombron & Jacquinot in Rousseau, Voy.Pole Sud 5:88, Atlas pl.22, figs.13,14.
1864. *Coralliophila confragosa* H. & A.Adams, Proc.Zool.Soc.Lond. for 1863:432.
1868. *Sistrum triangulatum* Pease, Americ.J.Conch.3:278,pl.23,fig.15.
1869. *Murex fiscellum* Chemnitz, Kobelt, Martini-Chemnitz syst.Conch.-Cab. ed.2, 3(2):95,pl.33,figs.10,11.
1880. *Ricinula(Sistrum)fiscellum* Chem.,Tryon, Man.Conch. 2:188,pl.58, figs.251-257.
1899. *Sistrum fiscellum* Chemnitz, Hedley, Mem.Austral.Mus. 3(7):461 (ref. Tryon, 1880,pl.58,figs.251-257).
1911. *Sistrum(Morula)fiscellum* Chemnitz, Schepman, Siboga-Exped. 49d:357 (ref. Reeve,1845,pl.27,fig.124 and Tryon,1880,pl.58,figs.251-257).
1929. *Ricinula(Sistrum)fiscellum* Chemnitz, Dautzenberg, Faune Colon.Francaises p.226 (ref.Chemnitz,op.cit., pl.160,figs.1524,1525 and Tryon, 1880,pl.58,fig.252).
1935. *Morula fiscellum* (Chemnitz),Ostergaard, Bern.P.Bishop Mus.Bull. 131:37 (ref.Kobelt,1869,pl.33,figs.10,11 and Tryon,1880,pl.58,figs.251-257).
1952. *Morula fiscellum* (Chemnitz), Tinker, Pacific sea-shells p.92,facing pl., figs.top row.
1957. *Morula fiscella* Gmelin, Kaicher, Indo-Pacific sea-shells pl.3,fig.14.
1957. *Morula triangulata* Pease, Kaicher, *ibid.* pl.3,fig.7.
1957. *Morula triangulatum* (Pease), Demond, Pacific Science 11(3):312, textfig.20.
1957. *Morula fiscella* Gmelin, Demond, *ibid.* 11(3):312 (ref.Tinker,1952,pl. on p.93,figs.top row).
1966. *Morula fiscella* (Gmelin), Habe & Kosuge, Shells world col. 2:55,pl.20, fig.11.
1969. *Morula (Cronia)fiscella* (Gmelin), Cernohorsky, Veliger 11(4):311,pl.49, fig.25 (shell), fig.19 (radula).
1972. *Morula fiscella* (Gmelin), Cernohorsky, Marine shells Pacific 2:128, pl.36,fig.7; 1978 Cernohorsky, Bull.R.Soc.New Zealand 17:45.
1974. *Morula fiscella* Quirk & Wolfe, Seashells Hawaii p.10,fig.11.
1978. *Morula fiscella* (Gmelin), Hinton, Guide Austral.shells pl.38,figs.14,14a; 1978 Hinton, Guide shells Papua New Guinea pl.30,fig.13.
1978. *Morula triangulata* (Pease), Hinton, Guide Austral.shells pl.38,figs.15,15a.
1978. *Cronia triangulata* (Pease), Cernohorsky, Trop.Pacific mar.shells p.70, pl.20,fig.6.
1979. *Muricodrupa funiculus* (Wood), Kay, Hawaiian Mar.shells p.238,fig.831.
1980. *Morula fiscella* (Gmelin), Kohn, "Micronesica", J.Univ.Guam 16(2):221.
1980. *Morula triangulata* (Pease), Zipser & Vermeij, "Micronesica", J.Univ. Guam 16(2):230.
1981. *Muricodrupa funiculus* (Wood), Emerson & D'Attilio, Nautilus 95(2):80, figs.6a,b (radula), figs.8a,b (operculum).

TYPE LOCALITY. Pulo Condore I, near China *(fiscellum);* none *(funiculus; iostoma; confragosa);* Tongatabu, Tonga Is *(ricinuloides);* Manila, Philippines *(pothuanii);* Solomon Is *(stellaris);* Hogoleu I [= Truk I, Caroline Is] *(muricoides);* Hawaiian Is *(triangulatum);* Bohol, Philippines *(decussatus).*

Cronia margariticola margariticola (Broderip,1833) (Figs. 15-18)

1795. *"Murex undatus"* Chemnitz, Neues syst.Conch.-Cab. 11:124,pl.192, figs.1851,1852 (non binom.).
1817. *Murex undatus* Dillwyn, Desc.cat.Rec.shells 2:732 (ref. Chemnitz,op.cit., pl. 192,figs.1851,1852 (non Gmelin,1791).
1832. *Purpura fiscella* Lam.,Blainville, Nouv.Ann.Mus.d'Hist.Nat.Paris 1:206, pl.10,fig.8 (non *Murex fiscellum* Gmelin,1791).
1832. *Purpura squamosa* Deshayes in Belanger, Voy.Indes-Orient. p.427,pl.2, figs.6-8 (non Lamarck,1816).

1833. ? *Purpura thiarella* Lamarck, Quoy & Gaimard, Voy.L'Astrolabe, Zool. 2:571, pl.39,fig.6 (shell), fig.4(animal),fig.5 (operculum).
1833. *Murex margariticola* Broderip, Proc.Zool.Soc.Lond. Pt.2:177 (publ. 14 January 1833).
1834. *Murex margariticola* Brod., Sowerby, Conch.Illust. Pt.60: fig.21.
1835. *Purpura fiscella* Lam., Kiener, Spec.gen.icon.coq.viv. 8:30,pl.6,fig.12.
1844. *Purpura squamulosa* Deshayes in Deshayes & Edwards, Hist.nat.anim.s.vert. ed.2, 10:104 (nom.subst.pro *P.squamosa* Deshayes in Belanger,1832 (non *P.squamulosa* Gray,1839).
1845. *Murex margariticola* Brod., Reeve, Conch.Iconica 3:pl.34,sp.178.
1862. *Ricinula fiscellum* Chemnitz, Küster, Martini-Chemnitz syst.Conch.-Cab. ed.2, 3(1e):20,pl.4,fig.1.
1870. *Murex undatus* Chemnitz, Kobelt, *ibid.*, 3(2):121,pl.36,figs.7,8.
1879. *Sistrum undatum* Chemnitz, E.A.Smith,Proc.Zool.Soc.Lond. p.213 (ref. Chemnitz, op.cit., pl.192, figs.1851,1852.
1880. *Ricinula (Sistrum)undata* Chemnitz, Tryon, Man.Conch. 2:189,pl.59,figs.260,262,263 only; 1929 Dautzenberg, Faune Colon.Francaises p.435; 1932 Dautzenberg, J.Conchyl. 76:42.
1891. *Pentadactylus undatus* Chemnitz, P.Fischer, Soc.Hist.Nat.Autun p.149.
1905. *Sistrum undatum* Chemnitz, Dautzenberg & Fischer, J.Conchyl. 53(2):122; 1906 Dautzenberg & Fischer, J.Conchyl. 53(4):395.
1910. ? *Ricinula(Sistrum)undata* var.*albovaria* Küster, Dautzenberg, J.Conchyl. 58:27.
1911. *Sistrum(Morula)undata* Chemnitz, Schepman, Siboga-Exped. 49d:357 (ref. Chemnitz, op.cit., pl.192,figs.1851,1852).
1916. *Drupa margariticola* Brod., Hedley, J.R.Soc.West Australia 1:65 (ref. Reeve, 1845, pl.34,sp.178).
1938. *Drupa(Morula)margariticola* (Broderip), Adam & Leloup, Mem.Mus.R.d'Hist. Nat.Belg. 2(19):161,pl.6,fig.16.
1957. *Morula undata* Lamarck, Kaicher, Indo-Pacific sea-shells, pl.4,fig.2.
1959. *Drupa(Cronia)margariticola* Brod.,Barnard, Ann.Sth.African Mus. 45(1):229, fig.50c (radula) (ref.Chemnitz, op.cit.,pl.192,figs.1851,1852).
1967. *Cronia margariticola* (Brod.),Habe & Kosuge, Stand.Cat.Jap.shells col. 3:69,pl.27,fig.7.
1967. *Drupa(Morula)fiscella* (Gmelin),Orr-Maes, Proc.Acad.Nat.Sci.Philadelphia 119 (4):130,pl.11,fig.H.
1969. *Morula(Cronia)margariticola* (Broderip),Cernohorsky, Veliger 11(4):312,pl.49,fig.26 (shell), figs.20a,b (radula); 1977 Cernohorsky, Bull.R. Soc.New Zealand 17:45.
1975. *Morula margariticola* (Brod.), Oliver, Shells world p.180,fig.left, 1975 Salvat & Rives, Coq.Polynésie p.317,fig.216; 1978 Hinton, Guide shells Papua New Guinea pl.30,figs.9,9a.
1981. *Cronia fiscella* (Gmelin), Emerson & D'Attilio, Nautilus 95(2):81,fig.9 (figd. lectotype of *Murex margariticola* Broderip).

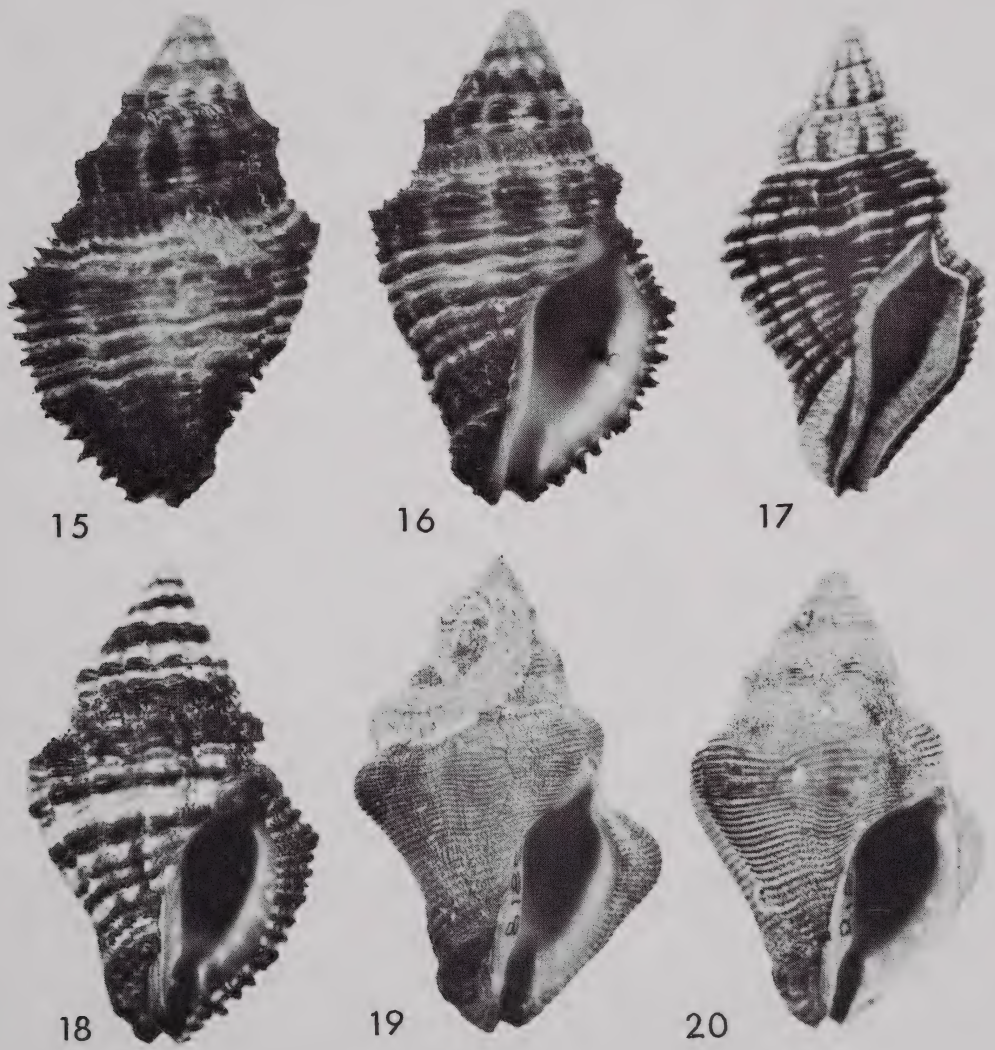
TYPE LOCALITY. Coasts of Tranquebar, India *(undatus);* west coast of India *(squamosa* and *squamulosa);* Lord Hood's I, Pacific Ocean [= Marutea I, Gambier Is, French Polynesia] *(margariticola).*

Cronia margariticola crassulnata (Hedley,1915) (Figs. 19,20)

1846. *Ricinula fiscellum* Chemnitz, Reeve, Conch.Iconica 3:pl.4,fig.28 (non *Murex fiscellum* Gmelin,1791).
1853. *Purpura fiscella* var.(pars) Hombron & Jacquinot in Rousseau, Voy.Pole Sud, Atlas pl.22,figs.19,20 only.
1884. *Sistrum undatum* var. E.A.Smith, Rept.Zool.coll.voy.H.M.S.''Alert'', p.51 (ref. to *Ricinula fiscellum* Reeve,1846, pl.4,fig.28).
1880. *Ricinula(Sistrum)undata* Chemnitz (pars),Tryon,Man.Conch. 2:189,pl.59, fig.259 only.
1915. *Thais crassulnata* Hedley, Proc.Linn.Soc.N.S.W. 39(4):749,pl.85,fig.90.

1923. *Morula rhyssa* Dall, Proc.Acad.Nat.Sci.Philadelphia 75:304 (nom.subst. pro *Ricinula fiscella* Reeve,1846, pl.4,fig.28).
1971. *Morula margariticola* Broderip, Wilson & Gillett, Australian shells p.92, pl.61,fig.9.
1978. *Cronia crassulnata* (Hedley),Cernohorsky, Trop.Pacific mar.shells p.69, pl.20,fig.6.

TYPE LOCALITY. Sweers I, Gulf of Carpentaria, Nth.Australia *(crassulnata);* Australia *(rhyssa).*



Figs. 15-20. *Cronia margariticola margariticola* (Broderip). 15,16. Lectotype BM(NH) No.1981146, 25.3 mm. 17. Type figure of *Purpura squamosa* Deshayes in Bélanger and *P.squamulosa* Deshayes in Deshayes & Edwards (from Deshayes in Bélanger, 1832, fig.6). 18. Specimen from Viti Levu Bay, Fiji Is; 23.2 mm. 19,20. *Cronia margariticola crassulnata* (Hedley). 19. Lectotype AMS No. C-15818; 31.7 mm. 20. Paralectotype AMS; 25.8 mm.

History of the three taxa

Chemnitz (1788) described the species *''Murex fiscellum''* from Pulo Condore, near China, in a non-binomial work which has been suppressed for nomenclatural purposes by the International Commission on Zoological Nomenclature. The German equivalent for the species was ''Der Maulkorb'' (= the muzzle), indicating a sculptural pattern which is repeated in Chemnitz's Latin description of ''testa angulata, clathrata, fenestrata, crispata''. His original description of the sculpture and colour is as follows:

''. . . . . The species has many longitudinal, angulate folds which appear to consist of overlapping, coarse, frilled leaves. Across these folds are positioned yellowish cords which give the shell a fenestrate appearance. In the interspaces of these fenestrations one sees holes and depressions which have a blackish base and giving the shell the appearance of having small windows. The coarse, wrinkled longitudinal folds and yellowish spiral cords are also visible on the upper whorls. The thick outer lip is inside full of small white denticles, and also under the other folds of the surface one sees in the interior traces of small denticles [= immature specimen] which the artist wanted to depict since he drew in the interior of the violet aperture a few whitish denticles, which must not be mistakenly assumed to be the denticles of the inner lip [= columella], which is completely smooth'' (Free translation).

Gmelin (1791) validated *Murex fiscellum* in a binomial sense through a brief two line description and citation to the text and figures of Chemnitz's *''Murex fiscellum''*. Chemnitz's original description leaves absolutely no doubt whatsoever that his species was the *fiscellum* of authors (= *funiculus* Wood) since the fenestrate sculpture, blackish depressions and yellowish-white colour of the shell are characters incompatible with *Murex margariticola* Broderip. The artist's rendering of *Murex fiscellum* in figs. 1524 and 1525 of Chemnitz (1788), did not do justice to Chemnitz's precise description, but has, nevertheless, more features in common with *fiscellum auct.* than with *margariticola* (Figs. 1,2).

That Chemnitz several years later (1795) acted as his own reviser in differentiating between the two similar taxa *fiscellum* and *margariticola* (= *undatus* Chemnitz) has been overlooked by Emerson & D'Attilio (1981). Chemnitz (1795) stressed the following differences in characters in his description:

''This species (= undatus) must not be confused nor be considered identical with the South Sea one originating from the Chinese island of Pulo Condore, and which I described in volume 10, figures 1524-1525, because they differ appreciably. This species (= *fiscellum*) is covered with scalloped, granose and frilled folds and encircled by elevated yellowish-white cords and appears through depressions to be clathrate and at the same time to be equipped with windows. Also the greyish-white colouring is totally different and the aperture is violet. The species depicted here (= *M.undatus*) is black and only in the intermediate grooves is a white background colour visible . . .''. (Free translation).

In his subsequent 1795 description Chemnitz made it quite clear that his *M.fiscellum* of 1788 (= *funiculus* Wood) and his *M.undatus* (= *M.margariticola*) are different species, and he stressed the ''greyish-white'' colour of *fiscellum* which never occurs in *margariticola*. Although *M.undatus* has been validated by Dillwyn (1817) and would have chronological priority over *M.margariticola* Broderip, it is a primary homonym of *M.undatus* Gmelin,1791, and thus not available.

The next reviser of *''Murex fiscellum''* Chemnitz, was Dillwyn (op.cit.), who discussed and supplied synonymies to most species appearing in the ''Neues systematisches Conchylien-Cabinet''. He gives an English description of *Murex fiscellum* Chemnitz, cites his original figures, but adds a very important additional reference with the words ''. . . . and it is well figured in Martyn's ''Universal Conchology'' but I am unable with sufficient certainty to determine the number of the plate''. The figures cited from Martyn (1784-86) are the best reproduction of a fully mature individual of *fiscellum auct.* (= *funiculus* Wood) at the time (Figs. 3,4). Our plate is also unnumbered. Dillwyn was the first author to have clarified the taxon *''fiscellum* Chemnitz''. The ''first reviser'' rule of Article 24 of the Code of ICZN cited by Emerson & D'Attilio (1981) has no bearing on the evaluation of any of the taxa discussed here since they have not been published simultaneously, an action which forms the basis of the ''first reviser'' rule.

Lamarck (1822) gave a standard 2½ line description and cited only the original reference to Chemnitz (1788) and Gmelin (1791), but the real identity of his species is not known. However, both Blainville (1832) and Kiener (1835-36) were the first authors to misinterpret *M.fiscellum* Gmelin, since they applied the epithet to the species *M.margariticola* Broderip.

Murex funiculus Wood,1828, and *M.ricinuloides* Quoy & Gaimard,1833, described from unknown locality and the Tonga Is respectively, are synonyms of *M.fiscellum* Gmelin, and neither name has been applied this century to a valid taxon. The types of both taxa have been lost and only the type-figures are available (Figs. 5,6).

Sowerby (1834) described the new species *Murex iostoma* but Sowerby (1841) and also E.Vokes (1971) re-assigned it to the synonymy of *M.fiscellum* Gmelin. The type is lost but the original type-figure is a good representation of *M.fiscellum* (Fig. 7).

Purpura squamosa Deshayes in Bélanger,1832, is an earlier name for *Murex margariticola* Broderip,1833, but fortunately it is a primary homonym of *P.squamosa* Lamarck,1816. It has been re-named *P.squamulosa* Deshayes in Deshayes & Edwards,1844, which is once again a homonym of *P.squamulosa* Gray,1839. The type of this taxon is now lost (Dr P. Bouchet, *in litt.*), and only the type-figure is available (Fig. 17).

Reeve (1845-46) appears to have been confused by the two taxa under discussion. In 1845 he illustrated the typical form of *Murex fiscellum auct.* and of Chemnitz (1788) [Reeve 1845-46, pl.27,fig.124]. This specimen is in the British Museum (Nat.Hist), London, and bears a label which reads: ''This without doubt is the true *fiscellum* of Chemnitz according to exact description. The figure is bad.'' (Figs. 9,10). Reeve further described the angulate form of the species as *Murex decussatus* Reeve,1845 (non Gmelin,1791), and also treated *M.margariticola* Broderip, as a separate species. The type of *M.decussatus* is lost and only the type-figure is available (Fig. 8). One year later Reeve (1846) had a change of heart and applied the name *''Ricinula fiscellum* Chemnitz'' to the Australian *crassulnata* subspecies of *Murex margariticola* Broderip.

Küster (1859-68) followed Blainville (1832) and Kiener (1835-36) in applying the taxon *''Ricinula fiscellum* Chemnitz'' to the species *Murex margariticola,* but Kobelt (1869-70) illustrated *''Murex fiscellum* Chemnitz'' which is the *M.fiscellum* Gmelin and of authors, and listed *M.margariticola* as *''M.undatus* Chemnitz''.

Other described forms of *Murex fiscellum* are: *Purpura pothuanii* Eydoux & Souleyet in Vaillant,1852, lectotype (here designated) length 19.6 mm, width 13.0 mm, in the Muséum National d'Histoire Naturelle, Paris (Figs. 13,14); *P.stellaris* Hombron & Jacquinot in Rousseau,1853, one immature syntype, length 15.8 mm, in the Muséum National d'Histoire Naturelle, Paris (Figs. 11,12); *Coralliophila confragosa* H. & A.Adams,1864, holotype length 30.4 mm in the British Museum (Nat.Hist.),London; *Sistrum triangulatum* Pease,1868, and *Purpura muricoides* Hombron & Jacquinot in Rousseau,1853.

E.A. Smith (1879) cited the species ''*Sistrum undatum* Chemnitz'' with *Murex margariticola* Broderip, in synonymy. He pointed out that the ''*Ricinula fiscellum*'' Reeve, was not the ''*Murex fiscellum* Chemnitz''. E.A. Smith (1884) reported a variation of *M.margariticola* from North Australia (subspecies *crassulnata*) and separated this form on the basis of its greater width, fewer and larger nodose plications and its finer and closer transverse squamose ridges.

Tyron (1880) also interpreted ''*fiscellum* Chemnitz'' as the *fiscellum* auct. and all 7 figures given by Tryon are of this species. He cites ''*undata* Chemnitz'' as a valid species with *margariticola* in synonymy.

H. Fischer (1901) cited *fiscellum auct.* under the name *Murex ricinuloides* Quoy & Gaimard, but remarked that a careful reading of Chemnitz's text would add weight to the supposition that *M.ricinuloides* Quoy & Gaimard is probably a synonym of ''*Ricinula fiscellum* Chemnitz'', but that the author's original figure is not precise enough to arrive at this conclusion with any certainty. In a footnote, Fischer (op.cit.) gave references to Chemnitz's volume 10 and 11 for differences between *Murex fiscellum* and *M.undatum*. E.Vokes (1971) also synonymized *M.ricinuloides* with *M.fiscellum*.

Schepman (1911) considered the *fiscellum* of Chemnitz to be the *fiscellum auct.* (= *funiculus* Wood) and warns that it should not be confounded with *Ricinula undata* (= *margariticola*).

Hedley (1915) discussed the problem surrounding ''*Murex fiscellum* Chemnitz'' and ''*M.undatus* Chemnitz'' at length and pointed out that the former taxon should be known by the binomial epithet *Murex fiscellum* Gmelin,1791, and the latter should be replaced with *M.margariticola* Broderip. Hedley (op.cit.) also felt that the North Australian form of *M.margariticola* illustrated and discussed by Reeve (1846), Tryon (1880), E.A.Smith (1884) and some other authors, was sufficiently distinct from *M.margariticola* to warrant the new name *crassulnata*. Dall (1923) overlooked Hedley's new taxon and proposed the substitute name *Morula rhyssa* for Reeve's ''*Ricinula fiscellum*''.

Conclusion

From the synonymic list it is evident that the great majority of authors interpreted *Murex fiscellum* Gmelin,1791, as the greyish-white, fenestrate species later named *Murex funiculus* Wood. During the 19th century 7 authors applied the epithet *fiscellum to* the greyish-white *fiscellum* auct. (= *funiculus* Wood), 9 authors proposed new taxa for the latter, 8 authors called the blackish-brown species either *undata* Chemnitz or *margariticola* Broderip and only 4-5 authors erroneously applied the taxon *fiscellum* to the latter species.

During the 20th century 15 authors applied *fiscellum* to the greyish-white *fiscellum* auct. (= *funiculus* Wood), 13 authors cited the blackish-brown species as either *undata* Chemnitz or *margariticola* Broderip, 4 authors proposed new taxa for the latter species and only 3 recent authors (Orr-Maes 1967, Kay 1979 and Emerson & D'Attilio 1981) had a different understanding of the species concept. The cited synonyms are overwhelming evidence that the epithet *fiscellum* Gmelin,1791, should continue in its accustomed sense which is contrary to the usage suggested by Emerson & D'Attilio (op.cit.).

Authors also disagree on the generic and even familial placement of *fiscellum* Gmelin and *margariticola* Broderip. Kay (op.cit.) assigned *fiscellum* Gmelin (as *funiculus* Wood) to the genus *Muricodrupa* Iredale, 1918, which she placed in the family Muricidae, and also considered Thaididae as a separate family. Emerson & D'Attilio (op.cit.) placed *fiscellum* Gmelin (as *funiculus* Wood) in the genus *Muricodrupa* and the species *margariticola* Broderip (as *fiscellum* Gmelin) they assigned to *Cronia* H. & A.Adams, and both genus-groups were placed in the Thaidinae. The radula of *fiscellum* Gmelin, *margariticola* Broderip, and *fenestrata* Blainville (Fig. 21 — ribbon only 2.1 mm in length in shell 23.0 mm in length, contains 89 rows + 2-3 nascentes) are all of the same type as the radula of *amygdala* Kiener, the type-species of *Cronia*. Shell-characters of the 4 species cited are also generically compatible and in my opinion *Cronia* is the appropriate genus-group applicable to this species-group with *Muricodrupa* for *fiscellum* Gmelin and *fenestrata* Blainville in a subgeneric sense.

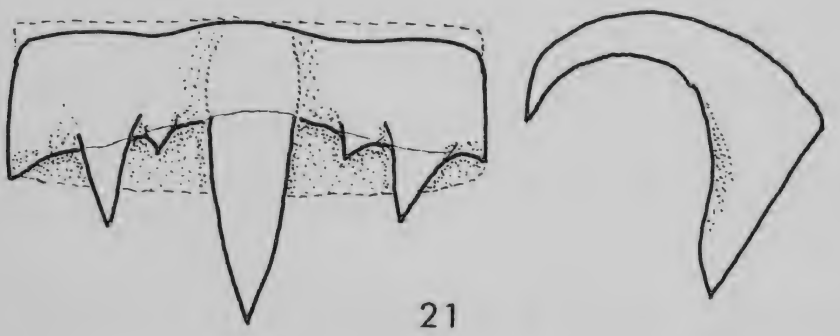


Fig. 21. *Cronia fenestrata* (Blainville) from Makatea, Tahiti, Society Is. Half-row of radula.

Emerson & D'Attilio (op.cit.) synonymized *Cronia crassulnata* (Hedley) with *C.margariticola* (Broderip), but the two forms are so prominently different that a subspecific separation at least is warranted. *C.crassulnata* is consistently broader and more subrhomboidal in shape, the axial ribs are very prominent and few in number (*c.* 6 in *crassulnata* and 10-13 in *margariticola*), the spiral striae are numerous and almost touching (30-40 in *crassulnata* and 15-20 in *margariticola*) and the spiral cords in *margariticola* are more nodulose and scabrous.

Acknowledgements. I would like to thank Dr P. Bouchet, Muséum National d'Histoire Naturelle, Paris, Dr J. Knudsen, University Zoological Museum, Copenhagen, Dr W. Ponder, Australian Museum, Sydney, and Ms K. Way, British Museum (Natural History), London, for information and loan of type specimens.

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THE TAXONOMY OF SOME INDO-PACIFIC MOLLUSCA

PART 10

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Abstract. Cronia ozenneana (Crosse,1861) has chronological priority over *C.gibba* (Pease,1865), and the radula of *C.musiva* (Kiener) is illustrated. *Morula porphyrostoma* (Reeve) is placed in synonymy of *M.dumosa* (Conrad) on the basis of its type specimen. The identity and synonymy of *Pascula benedicta* (Melvill & Standen), *Maculotriton serriale* (Deshayes in Laborde & Linant) and *Clivipollia bella* (Reeve), are elucidated from their type specimens. *Latiaxis fenestratus* Kosuge is placed in synonymy of *L.wormaldi* Powell and the type-specimen of *L.sibogae* Schepman, is illustrated. *Nassaria incerta* (King) and *Trajana woodringi* E.H. Vokes, are additional fossil species of the *Trajana-Nassaria* group, and the Australian *Nassaria problematica* (Iredale) is tentatively reported from New Zealand waters. The radula is illustrated and a new range-extension recorded for *Nassarius crebricostatus* (Schepman), and ovoviviparity is reported in *N.tabescens* (Marrat). New range-extensions are recorded for *Mitra subflava* (Kuroda & Habe), *M.vexillum* Reeve, and *Ziba rehderi* (Webb), and *Mitra pudica* (Pease) is re-assigned from the genus *Pterygia* to *Mitra* on the basis of its radular anatomy.

Family MURICIDAE

Subfamily THAIDINAE

Genus **Cronia** H. & A. Adams, 1853

Cronia H. & A. Adams,1853, Gen.Rec.Moll. 1:128. Type species by M *Purpura amygdala* Kiener,1835. Recent, Indo-Pacific.

Cronia ozenneana (Crosse,1861) (Figs. 1-3)

1861. *Ricinula ozenneana* Crosse, J.Conchyl. 9:285; 1862 Crosse, J.Conchyl. 10:49,pl.1, figs.4,5.
1865. *Latirus gibbus* Pease, Proc.Zool.Soc.Lond.p.54; 1868 Pease, Americ. J.Conch. 3(4):279, pl.23,fig.17.
1873. *Murex crossei* Lienard, J.Conchyl. 21:285; 1874 Lienard, J.Conchyl. 22:70,pl.1.fig.2.
1904. *Coralliophila dissimulans* Preston, J.Malac. 11(4):77,pl.7,figs. 5,6.
1979. *Cronia gibba* (Pease), Cernohorsky, Rec.Auckland Inst.Mus. 16:172, figs.6-10 (shells), fig.11 (radula).

TYPE LOCALITY. None *(ozenneana);* Howland I, Pacific Ocean *(gibba);* Mauritius *(crossei);* Ceylon *(dissimulans).*

Rec. Auckland Inst. Mus. 19: 125-147 17 December 1982

Type specimens. The holotype and 1 immature paratype of *Cronia ozenneana* (Crosse) are in the Muséum National d'Histoire Naturelle, Paris, dimensions of holotype length 14.5 mm, width 9.4 mm (Figs. 1,2) and paratype length 14.4 mm, width 9.5 mm (Fig. 3).

Cernohorsky (1979) reviewed the nomenclature of *Cronia gibba* (Pease) and illustrated the type specimens of the species. Further research, however, has turned up another prior name for the species and from examination of the type of *C.ozenneana* it is obvious that this taxon will have to replace *C.gibba* (Pease).

Genus **Morula** Schumacher, 1817

Morula Schumacher,1817, Essai nouv.syst. pp.68,227. Type species by M *M.papillosa* Schumacher,1817 = *Drupa uva* Röding, 1798.

Morula musiva (Kiener,1836) (Figs. 4,10,11)

1836. *Purpura musiva* Kiener, Spéc.gén.icon.coq.viv. 8:38,pl.9,fig.2.

TYPE LOCALITY. None.

The shell of this species has the appearance of a typical *Morula*,(Fig. 4), however, the radula is of the *Cronia* type. The radular ribbon is 3.8 mm long in a shell 23.1 mm in length, and has 174 rows of teeth + 6 rows of nascentes (Figs. 10,11). The rachidians lack the 2-3 small side denticles which are present in the radula of *M.uva* (Röding,1798), the type-species of *Morula*. However, in some individuals of *M.granulata* (Duclos), the side denticles become obsolete.

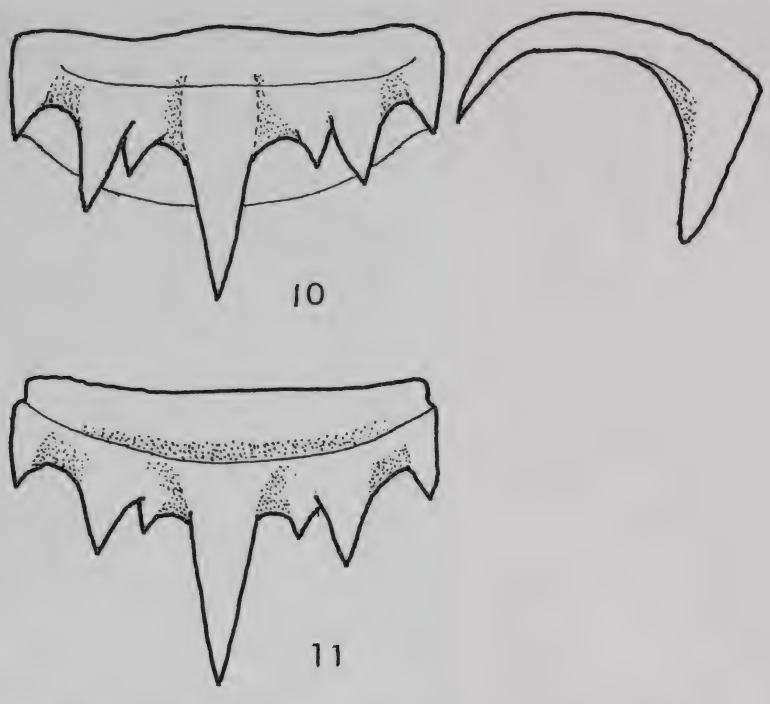
Morula dumosa (Conrad,1837) (Figs. 5-9)

1837. *Purpura dumosa* Conrad, J.Philad.Acad.Sci. 7:267,pl.20,fig.20.
1846. *Ricinula prophyrostoma* Reeve, Conch.Icon. 3:pl.2,sp.7.
1868. *Engina dumosa* Conrad, Pease, Americ. J.Conch. 4(3):123.
1880. *Ricinula(Sistrum)dumosa* Conrad, Tryon, Man.Conch. 2:188,pl.58,figs. 243,245 only.
1952. *Morula porphyrostoma* (Reeve), Tinker, Pacific sea shells p.90, plate facing p.90, cent.fig. top row; 1957 Kaicher, Indo-Pacific seashells, pl.3,fig.9.
1979. *Morula dumosa* (Conrad), Kay, Hawaiian mar.shells,sect.4:247,fig.87C.

TYPE LOCALITY. None *(dumosa);* Marquesas Is *(porphyrostoma)*.

Type specimens. The type specimen of *Purpura dumosa* Conrad, can no longer be located at the Academy of Natural Sciences, Philadelphia (Dr R. Robertson, *in litt.*). Four syntypes of *Ricinula porphyrostoma* Reeve, are in the British Museum (Nat.Hist.),London, No.1980128, and the specimen measuring length 17.8 mm, width 10.9 mm, height of aperture 11.4 mm, is here designated as the lectotype (Figs. 6,7). The lectotype has 6 whorls, 9 axial folds and 7 spiral cords on the penultimate and 9 folds and 18 cords on the body whorl, siphonal fasciole with 2 extra cords, outer lip with 7 denticles, lower half of columella with 4 denticles. Colour is grayish-white, aperture purple.

Figs. 1-9. 1-3 *Cronia ozenneana* (Crosse). 1,2. Holotype MNHN Paris; 14.5 mm. 3. Paratype MNHN Paris; 14.4 mm. 4. *Morula musiva* (Kiener). Tonga Is; 23.1 mm. 5-9. *M.dumosa* (Conrad). 5. Type-figure. 6-9. *Ricinula porphyrostoma* Reeve. 6,7. Lectotype BM(NH) No.1980128; 17.8 mm. 8. Paralectotype BM(NH); 18.2 mm. 9. Immature paralectotype BM(NH); 21.9 mm.



Figs. 10,11. *Morula musiva* (Kiener). Vavau, Tonga Is. 10. Half-row of radula. 11. Anterior view of rachidian tooth.

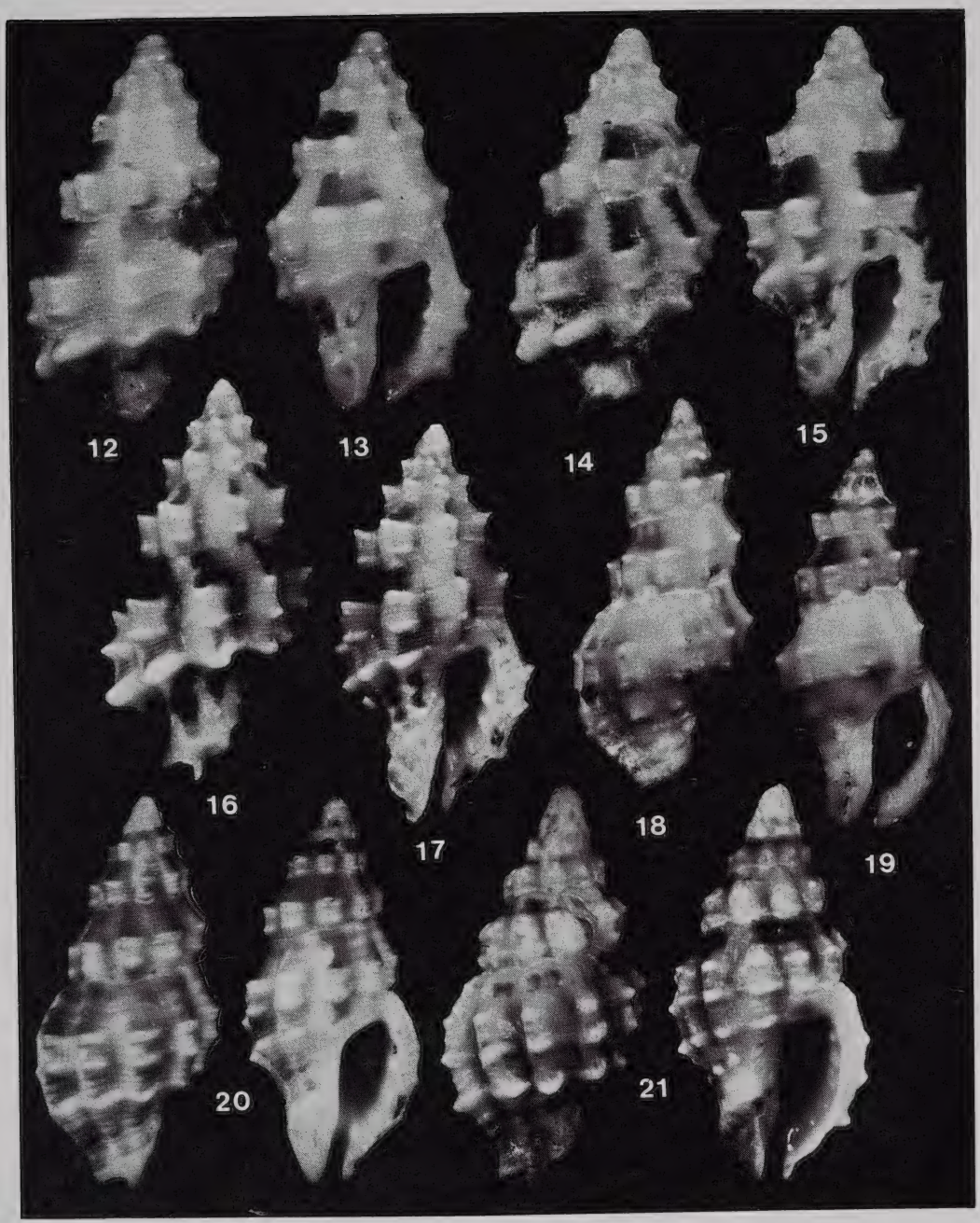
Already last century Pease (1868) realized that *dumosa* Conrad and *porphyrostoma* Reeve, were the same species. Kay (1979), however, considers *porphyrostoma* Reeve to be a separate species with a spinose rather than scalar sculpture and an ovate rather than pyriform shape. Since Conrad's type specimen is no longer extant a comparison can only be made between Conrad's (1837) mediocre type figure (Fig. 5) and description, and Reeve's existing syntypes of *porphyrostoma,* and the conclusion is that they are conspecific. Reeve's lectotype of *porphyrostoma* is almost identical in shape to the specimen illustrated by Kay as *dumosa* (op.cit., fig.87C), and the immature paralectotype of *porphyrostoma* has a more elongate form and spiral grooves instead of spiral cords (Fig. 9).

Genus **Pascula** Dall, 1908

Pascula Dall, 1908, Bull.Mus.Comp.Zoology Harvard 43(6):311. Type species by M *Trophon (Pascula)citricus* Dall,1908. Recent, Easter I, Pacific.

Pascula benedicta (Melvill & Standen,1895) (Figs. 12-20)

1895. *Murex (Ocinebra)benedictus* Melvill & Standen, J.Conch. 8:108,pl.2,fig.13.
1903. *Pentadactylus paucimaculatus* Sowerby, Ann.Mag.Nat.Hist. (7), 12:496.
1952. *Drupa benedicta* (Melvill & Standen), Kuroda & Habe, Check-list & Bibl. mar.moll.Japan, p.54.
1952. *Drupa paucimaculata* (Sowerby), Kuroda & Habe, *ibid.*, p.54.
1960. *Drupa(Morulina)benedicta* (Melvill),Azuma, Cat.Moll.Shikoku,Japan, p.35.
1960. *Drupa(Morulina)paucimaculata* (Sowerby), Azuma, *ibid.*, p.35.



Figs. 12-21. 12-17. *Pascula benedicta* (Melvill & Standen). 12,13. Holotype UM Manchester; 6.4 mm. 14,15. Specimen from Moruroa Atoll, Tuamotu Archipelago; 6.1 mm. 16,17. Specimen from Guam I, Marianas Is; 7.1 mm. Figs. 18-20. Forma *paucimaculata* Sowerby. 18,19. Holotype BM(NH); 11.8 mm. 20. Specimen from unknown locality, NM Wales; 9.2 mm. 21. *P. cf. citrica* (Dall). Punta Engano, Mactan, Philippines; 11.1 mm.

TYPE LOCALITY. Lifu, Loyalty Is *(benedicta);* Hachijojima, Izu, Japan *(paucimaculata).*

Type specimens. The holotype of *Murex benedictus* Melvill & Standen, is in the University of Manchester Museum, length 6.4 mm, width 3.3 mm. The type has 6 mature whorls and a partly worn protoconch, 8 axial ribs, 2 rows of nodes and 7 spiral striae on the penultimate and 9 axial ribs, 3 main rows of nodes+ 3 nodulose cords and *c.* 17 fine striae on the body whorl; the outer lip has 5 denticles and the columella 2 minute denticles anteriorly; colour is white with a few reddish-brown blotches (Figs. 12,13).

The holotype of *Pentadactylus paucimaculatus* Sowerby, is in the British Museum (Nat.Hist.),London, length 11.8 mm, width 5.3 mm. There are 5 mature whorls and 3 smooth embryonic whorls, 9 axial ribs and 2 rows of nodes on the penultimate and 9 axial ribs, 3 main rows of nodes + 2 nodulose cords and some fine intermediate spiral striae on the body whorl; the outer lip has 8 small denticles and the columella 1 obsolete denticle anteriorly; although faded, orange-brown blotches are still discernible (Figs. 18,19).

The species has been reported from Japan in recent years but has not been illustrated nor have additional records been reported. The species is variable in form, and a better specimen of the slender *paucimaculata* form from unknown locality from the Cox collection in the National Museum of Wales, Cardiff, shows the large areas of brown on a creamy-white background and additional spiral lines (Fig. 20). A very small, 6.1 mm long individual closely resembling the holotype of *benedicta* has been collected at Moruroa Atoll, Tuamotu Archipelago (*leg.* C.Beslu) [Figs. 14,15], while an intermediate form has been found on Anae I, Guam I, Marianas Is (*leg.* Dr Munroe) [Figs. 16,17]. Fresh specimens show a macroscopic sculptural pattern of very fine axial and spiral striae with a fine net-like effect, the spiral nodes are frequently echinate and most prominent upon the axial ribs with the third anterior row of nodes on the body whorl usually the most pronounced; the aperture is white and occasionally tinged with violet and the protoconch has 3-3½ smooth, conical whorls.

Rehder (1980) discussed the status of *Pascula* Dall at length and also illustrated the lectotype of *P.citricus* Dall. I agree with Rehder's conclusions that the genus *Pascula* is closer in radular and shell characters to the *Morula-Cronia* group of species in the subfamily Thaidinae rather than *Trophon* in the Trophoninae or *Muricopsis* in the Muricopsinae. *Murex benedictus* also belongs to the *Pascula* group since it closely resembles *P.citrica.* A specimen of a species very similar or conspecific with *P.citrica* from Punta Engano, Cebu, Philippines, is here illustrated (Fig. 21).

Genus **Maculotriton** Dall, 1904

Maculotriton Dall, 1904, Smithsonian misc.coll. 47(1475): 136. Type species by OD *Triton bracteatus* Hinds,1844 = *Buccinum serriale* Deshayes in Laborde & Linant,1834. Recent, Indo-Pacific.

Maculotriton serriale (Deshayes in Laborde & Linant, 1834) (Figs. 22-30)

1834. *Buccinum serriale* Deshayes in Laborde & Linant, Voy.L'Arabie Petrée, p.66, figs.32-34; 1926 Lamy, Bull.Mus.Hist.Nat.Paris 32(2):382; 1928 Tomlin & Salisbury, Proc. Malac.Soc.Lond. 18:33,35.

1844. *Triton angulatus* Reeve, Conch.Icon. 2:pl.19,sp.88 (publ.June 1844).

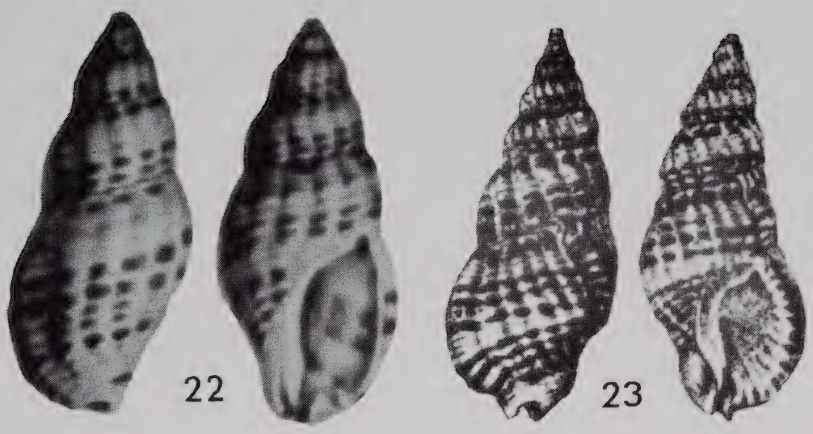
1844. *Triton bracteatus* Hinds, Proc.Zool.Soc.Lond. pt.12:21 (publ.July 1844); 1844 Hinds, Zool.voy.H.M.S.''Sulphur'', pt.1:11, pl.4,figs.5,6.
1848. *Colombella epidelia* Duclos in Chenu, Illust.Conchyl. pl.25,figs.17,18.
1872. *Tritonidea petterdi* Brazier, Proc.Zool.Soc.Lond. p.22; 1901 Tate & May, Proc.Linn.Soc. N.S.W. 26(3):450.
1881. *Triton(Epidromus)bracteatus* Hinds, Tryon, Man.Conch. 3:29,pl.15,fig.141.
1896. *Clathurella (?) waterhouseae* Brazier, Proc.Linn.Soc.N.S.W. 21(3):345.
1899. *Clathurella waterhousiae* Brazier, Hedley, Proc.Linn.Soc.N.S.W. 24(3): 434, fig.7.
1904. *Maculotriton bracteatus* (Hinds), Pilsbry & Vanatta, Proc.Acad.Nat.Sci.Philad. 56:593, fig.3 (radula); 1906 Hedley, Proc.Linn.Soc.N.S.W. 30(4):529; 1915 *Oliver, Trans.* .N.Z.Inst. 47:534; 1952 Tinker, Pacific sea shells, p.102, pl.opposite, figs.top row; 1972 Ponder, J.Malac.Soc. Australia 2(3):226, pl.23,figs.1-5 (shell),figs.1/5, 1/6 (radula) [figd. holotype of *petterdi* and *waterhouseae*]; 1979 Kay, Hawaiian mar.shells Sect.4:246,figs. 87I, J.
1904. *Maculotriton bracteatus longus* Pilsbry & Vanatta, Proc.Acad.Nat.Sci.Philad. 56:595; 1905 Pilsbry, Proc.Acad.Nat.Sci.Philad. 57:103,pl.3, fig.13; 1964 Habe, Shells west.Pacific col. 2:83,pl.27, fig.4.
1933. *Colubraria bracteata* Hinds, Dautzenberg & Bouge, J.Conchyl. 77:256.
1952. *Drupa serrialis longus* (Pilsbry & Vanatta), Kuroda & Habe, Check-list & Bibl.rec.mar.Moll.Japan, p.54; 1967 Habe & Kosuge, Stand.book Jap. shells col. 3:69, pl.27,fig.8.
1956. *Maculotriton bracteata* (Hinds), Cotton, Malac.Club Victoria Publ. No.1:4, fig.17; 1974 Dance, Encycl.shells p.129, bottom figs.
1960. *Drupa(Maculotriton)serrialis longus* (Pilsbry & Vanatta), Azuma, Cat. Moll.Shikoku, Japan p.35.
1967. *Maculotriton serriale* (Deshayes in Laborde), Orr-Maes, Proc.Acad.Nat.Sci.Philad. 119:132, pl.12,fig.L; 1972 Cernohorsky, Mar.shells Pacific 2:129,pl.36,fig.11; 1975 Salvat & Rives, Coquill.Polynésie, p.317,fig.217; 1978 Hinton, Guide Austral.shells, pl.38,fig.23.
1981. *Drupa(Maculotriton)serriale* (Deshayes in Laborde), Robertson, Tryonia No.4:6.

Synonymy of forma *digitalis* Reeve

1844. *Triton digitalis* Reeve, Conch.Icon. 2:pl.19,sp.86 (publ.June 1844).
1844. *Triton lativaricosus* Reeve, *ibid.* 2:pl.19,sp.90 (publ.June 1844).
1844. *Triton bacillum* Reeve, *ibid.* 2:pl.19,sp.94 (publ.June 1844).
1904. *Maculotriton digitalis* (Reeve), Pilsbry & Vanatta, Proc.Acad.Nat.Sci.Philad. 56:593,fig.1 (protoconch), fig.2 (radula).
1907. *Eutriton(Epidromus)digitalis* Couturier, J.Conchyl. 55(2):147,pl.2, figs.4,5.
1907. *Eutriton(Epidromus)digitalis* var.*seurati* Couturier, *ibid.* 55(2):147, pl.2,figs. 6-8.
1933. *Colubraria digitalis* (Reeve), Dautzenberg & Bouge, J.Conchyl. 77:256.
1957. *Maculotriton digitalis* (Reeve), Demond, Pacific Science 11:313,fig.21; 1967 Orr-Maes, Proc.Acad.Nat.Sci.Philad. 119:131,pl.12,fig.M.
1960. *Drupa(Maculotriton)digitalis* (Reeve), Azuma, Cat.Moll.Shikoku,Japan,p.35.

TYPE LOCALITY. Red Sea *(serriale);* Ticao I, Philippines *(angulatus);* Capul I, Philippines *(digitalis);* none *(lativaricosus; bacillum; epidelia);* Straits of Malacca, Indonesia *(bracteatus* — here restricted); N.E. coast of Tasmania = error; actually from Bird I, N.E. Australia *(petterdi);* N.Head of Botany Bay, N.S.W., Australia *(waterhouseae);* Tanabe, Kii, Japan *(longus);* Rikitea; Marutea, Gambier Is, Polynesia *(seurati).*

Distribution. Red Sea to Japan, Eastern Australia, Hawaii and the Marquesas Islands.

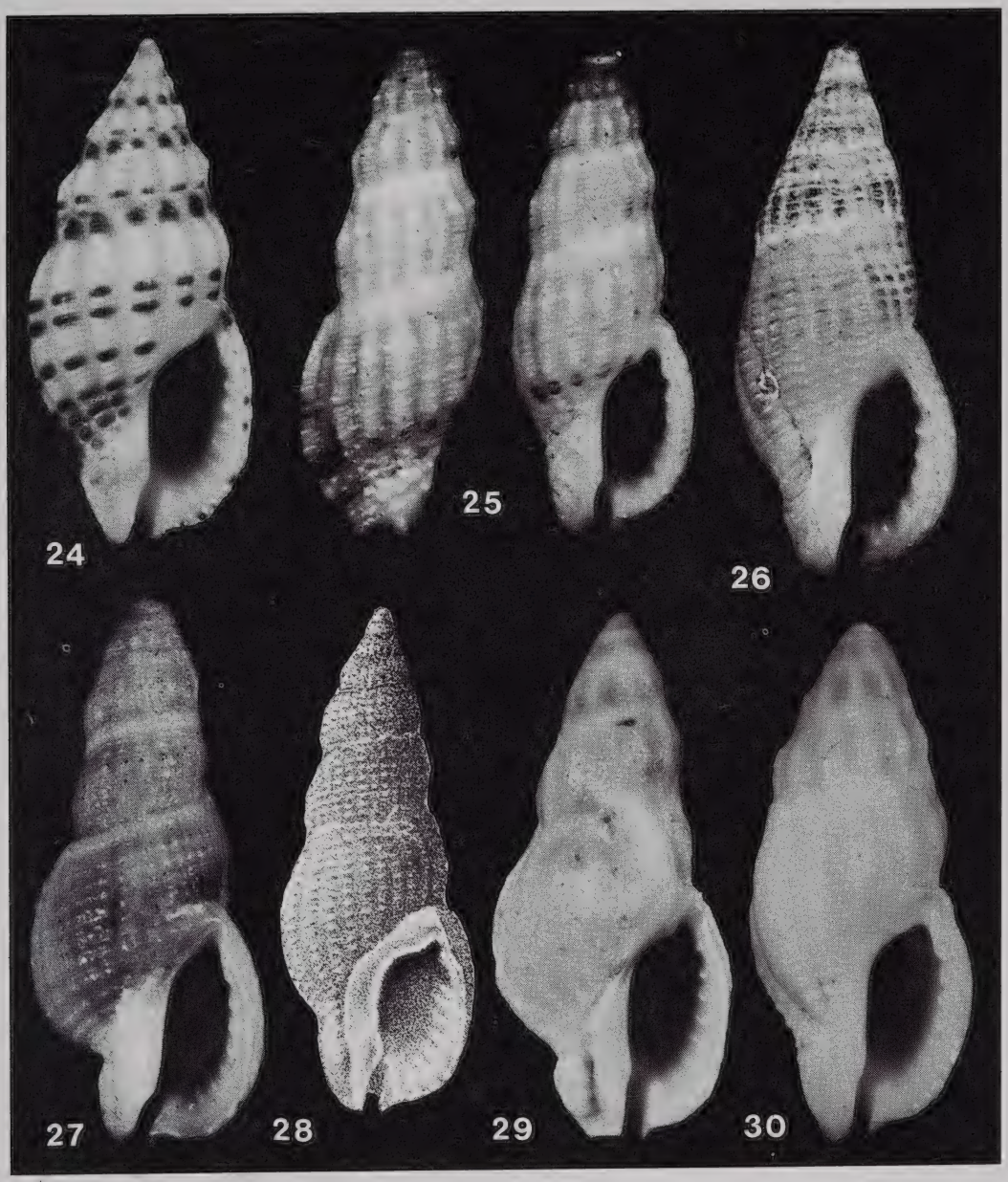


Figs. 22,23. *Maculotriton serriale* (Deshayes). 22. Illustrated lectotype (from Deshayes in Laborde & Linant,1834, figs.32,33). 23. Illustrated lectotype of *Triton bracteatus* Hinds (from Hinds, 1884, pl.4, figs.5,6).

Type specimens. The type specimen of *Buccinum serriale* Deshayes, can no longer be found in the Museum National d'Histoire Naturelle,Paris (Dr P. Bouchet, *in litt.*), and the type specimen of *Triton bracteatus* Hinds, which should be in the British Museum (Nat.Hist.),London, is no longer extant either (Ms K.Way, *in litt.*). The species respective type-figures are here designated as being representative of the lectotypes (Figs. 22,23). The following type specimens are in the British Museum (Nat.Hist.),London: The holotype of *Triton digitalis* Reeve, No.1967645, dimensions 12.7 x 5.0 mm (Fig. 26), and the holotype of *T.angulatus* Reeve, No.1908058, dimensions 12.2+ x 4.6 mm (Fig. 25); three syntypes of *T.lativaricosus* Reeve, No.198059, and the illustrated syntype, dimensions 21.4 x 9.6 mm, is here designated as the lectotype (Fig. 29); two syntypes of *T.bacillum* Reeve, No.1967648, and the illustrated syntype, dimensions 20.5 x 8.6 mm, is here designated as the lectotype (Fig. 27).

Maculotriton serriale is a very variable, common intertidal muricid gastropod from the Indo-Pacific region which is found on the underside of coral rocks, usually within the intertidal zone. Due to its high variability of shell characters it had a confused taxonomic history and received no fewer than 11 names. Some recent authors (Ponder 1972; Dance & Cameron 1974; Kay 1979) continue using *M.bracteatus* (Hinds), despite earlier papers by Lamy (1926) and Tomlin & Salisbury (1928) pointing out the chronological priority of *M.serriale*. The synonymous taxa *Triton angulatus,* Reeve,1844, *T.digitalis,* Reeve,1844 *T.bacillum* Reeve,1844, and *T.lativaricosus* Reeve,1844, have a 1 month chronological priority over *M.bracteatus* (Hinds).

Orr-Maes (1967) doubted that *M.digitalis* should be separated from *M.serriale* since both occured on seaward reefs at Coso-Keeling I, and many intermediate forms linking the two were recorded. Ponder (1972) added 2 synonyms to the species-group under discussion by illustrating the type-specimens of *Tritonidea petterdi* Brazier and *Clathurella waterhouseae* Brazier, and pointed out that *M.digitalis* (Reeve) may prove to be a synonym of *M.bracteatus* (=*serriale*). Other authors either separate or combine the two forms.



Figs. 24-30. *Maculotriton serriale* (Deshayes). 24. Ventricose specimen resembling type-figure from Guam I, Marianas Is; 15.2 mm. 25. Holotype of *Triton angulatus* Reeve, BM(NH) No. 198058; 12.2 + mm. 26. Holotype of *T.digitalis* Reeve, BM(NH) No. 1967645; 12.7 mm. 27. Lectotype of *T.bacillum* Reeve, BM(NH) No. 1967648; 20.5 mm. 28. Type-figure of *Eutriton digitalis* var.*seurati* Couturier (from Couturier, 1907, pl.2,fig.7). 29,30. *Triton lativaricosus* Reeve. 29. Lectotype BM(NH) No.1980059; 21.4 mm. 30. Paralectotype BM(NH); 17.5 mm.

M.serriale varies greatly in shape, sculpture and colouring. Whorls range from inflated convex to almost flat and many individuals are weakly subangulate anterior to the sutures. Sculpture is fine or coarse and mature specimens frequently form one or more varices. The general colour pattern consists of a few spiral rows of reddish-brown spots upon the laterally elongated nodules on a greyish-white background, but the spots are frequently obsolete and many individuals are uniformly greyish-white or fawn in colour.

The taxa *Triton angulatus* Reeve, *T.bacillum* Reeve, and *T.lativaricosus* Reeve, are added to the synonymy of *Maculotriton serriale* on the basis of the identity of their type-specimens.

Family CORALLIOPHILIDAE

Genus **Latiaxis** Swainson, 1840

Latiaxis Swainson, 1840, Treat.Malac. p.306. Type species by M *Pyrula mawae* Gray in Griffith & Pidgeon,1834. Recent, Indo-Pacific.

Latiaxis wormaldi Powell,1971 (Figs. 31-33)

1971. *Latiaxis wormaldi* Powell, Rec.Auckland Inst.Mus. 8:220,figs.15,16; 1979 Powell, New Zealand Moll. p.182,pl.35,figs.3,4.
1980. *Latiaxis(Echinolatiaxis)fenestratus* Kosuge,Bull.Inst.Malac.Tokyo 1(3):42,pl.10, figs.10,11.

TYPE LOCALITY. E.S.E. of Poor Knights Is, New Zealand, 329 m *(wormaldi);* off Mactan, Cebu, Philippines *(fenestratus).*

Type specimens. The holotype of *L.wormaldi* Powell, is in the Auckland Institute and Museum No. TM-1329, dimensions length 22.7 mm, width 19.8 mm (Figs. 31,32). The holotype of *L.fenestratus* Kosuge, is in the Institute of Malacology, Tokyo, No.IMT-80-10, length 28.7 mm, width 19.5 mm (Fig. 33).

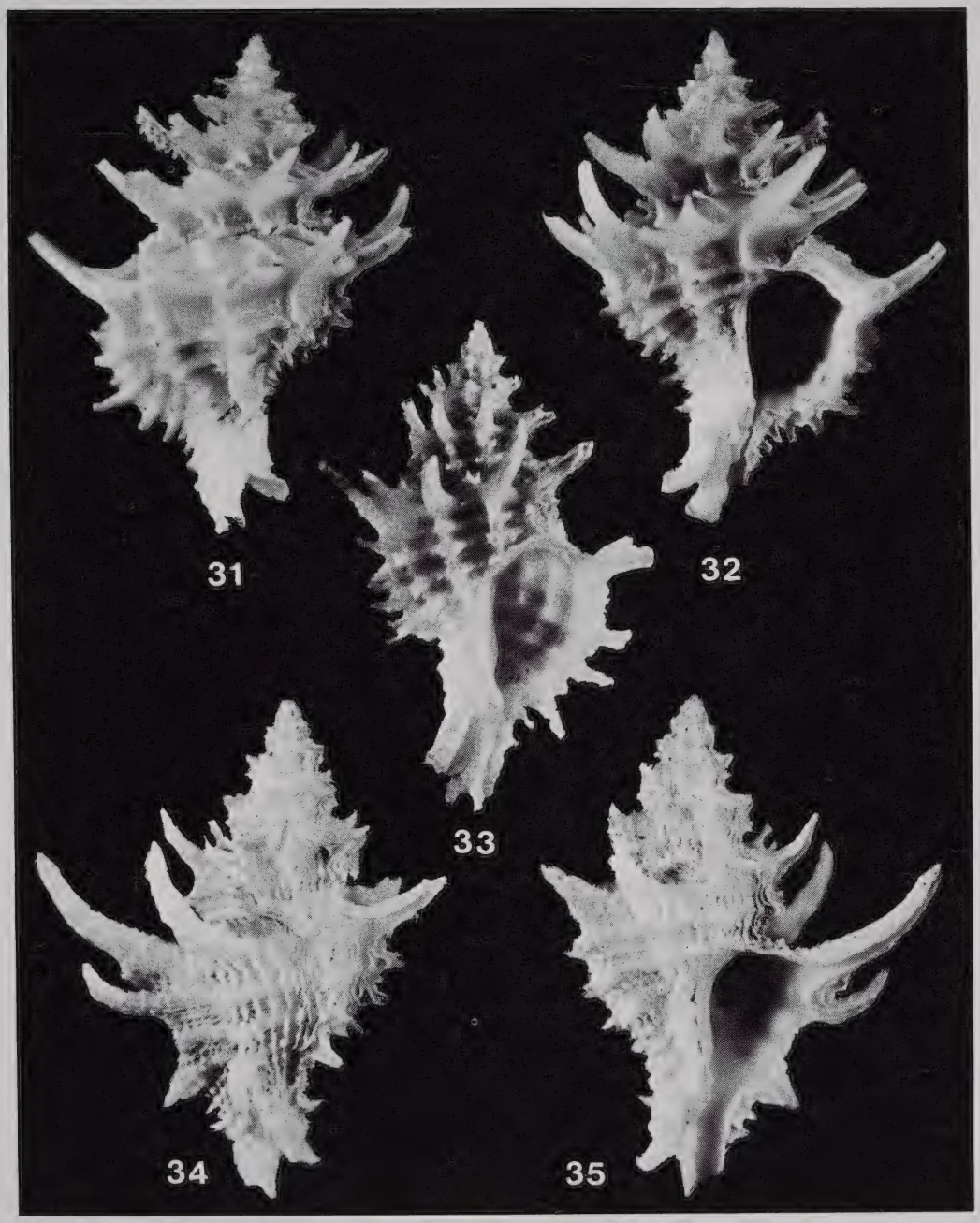
Although described as a new species from the Philippines, the holotype of *L.fenestratus* is a somewhat more slender individual of *L.wormaldi*. The paratype of *L.fenestratus,* however, (width-ratio 89%) is even broader than the holotype of *L'wormaldi* (width-ratio 87%). *L.sibogae* Schepman,1911, from Indonesia, is similar to *L.wormaldi* but differs in its rougher sculpture of squamate lamellae and absence of brown colouring in the concave portion between axial and spiral sculpture (Figs. 34,35).

Family BUCCINIDAE

Genus **Cantharus** Röding, 1798

Subgenus **Clivipollia** Iredale, 1929

Clivipollia Iredale,1929, Austral.Zoolog.5(4):347. Type species by M *C.imperita* Iredale,1929 = *Ricinula pulchra* Reeve,1846. Recent, Indo-Pacific.



Figs. 31-35. 31-33. *Latiaxis wormaldi* Powell. 31,32. Holotype AIM No. TM-1329; 22.7 mm. 33. Holotype of *L.fenestratus* Kosuge; 28.7 mm (from Kosuge, 1980, pl.10,fig.10). 34,35. *L.sibogae* Schepman. Holotype ZM Amsterdam: 16.4 mm.

Cantharus (Clivipollia) fragaria (Wood,1828) (Fig. 36)

1828. *Voluta fragaria* Wood, Suppl.Index Testac. p.11,pl.3,fig.27a.
1828. *Buccinum fragaria* Wood, *ibid.* p.31.
1840. *Turbinella carolinae* Kiener, Spéc.gén.icon.coq.viv. 6:47,pl.18,fig.1; 1876 Kobelt, Syst.Conch.-Cab.Martini & Chemnitz ed.2, 3(3A):50,pl.9a, figs.9,10.
1846. *Ricinula bella* Reeve, Conch.Icon. 3:pl.3,sp.15.
1868. *Engina bella* Reeve, Pease, Americ.J.Conch. 4(3):123; 1975 Salvat & Rives, Coquill. Polynesie p.319,fig.224.
1952. *Engina carolinae* (Kiener), Kuroda & Habe, Check-list & Bibl.rec.mar. Moll.Japan, p.55.
1964. *Clivipollia fragaria* (Wood), Hawaiian Shell News 12(10):2,figs.3,4; 1974 Quirk & Wolfe, Seashells Hawaii p.12, lower pl.,fig.2; 1979 Kay, Hawaiian mar.shells Sect.4:263,fig.92E.
1967. *Peristernia fragaria* (Wood), Orr-Maes, Proc.Acad.Nat.Sci.Philad. 119(4):136,pl.13, fig.E.
1974. *Engina elegans* Dunker, Dance & Cameron, Encycl.shells p.142,figs.bottom left column (non *Turbinella elegans* Dunker in Kobelt,1876).

TYPE LOCALITY. None *(fragaria* and *carolinae);* Capul I, Philippines *(bella).*

Type specimens. Three syntypes of *Ricinula bella* Reeve, are in the British Museum (Nat.Hist.),London, No. 1980131, and the illustrated syntype, length 19.9 mm, width 10.2 mm, is here designated as the lectotype (Fig. 36).

This well known species from the tropical Indo-Pacific region has received a mixed treatment in malacological literature and has been variously placed in the genera *Voluta, Buccinum, Turbinella, Ricinula, Engina, Peristernia* and *Clivipollia.* Even recent authors identify the species as either "*Engina elegans* Dunker" (Dance & Cameron 1974) or "*Engina bella* Reeve" (Salvat & Rives 1975). *Turbinella elegans* Dunker in Kobelt, 1876, which is a primary homonym of *T.elegans* Grateloup,1847, is actually the species *Cantharus(Clivipollia)pulcher* (Reeve,1846). The type-series of *Ricinula bella* Reeve, is undoubtedly the species *fragaria* Wood.

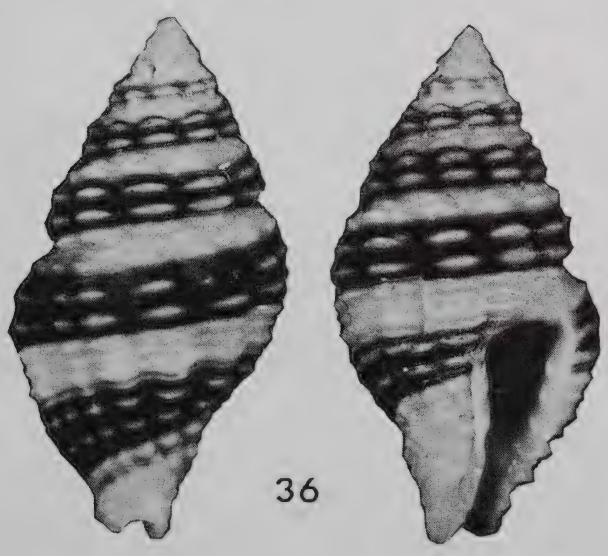


Fig. 36. *Cantharus(Clivipollia)fragaria* (Wood). Lectotype of *Ricinula bella* Reeve, BM(NH) No.1980131; 19.9 mm.

Genus **Nassaria** Link, 1807

Nassaria Link,1807, Beschr.Nat.-Samml.Univ.Rostock p.123. Type species by SD (Eames,1952) *N.lyrata* Link,1807 = *Neptunea pusilla* Röding,1798. Recent, Indo-Pacific.

Subgenus **Microfusus** Dall, 1916

The buccinid genera *Nassaria, Trajana* and *Neoteron* have recently been monographed by Cernohorsky (1981). In the meantime new information has come to hand which requires corrections to the mentioned monograph.

Nassaria(Microfusus)incerta (King,1933) (Figs. 37,38)

1933. *Austrofusus incertus* King, Trans.Proc.N.Z.Inst. 63(3):343,pl.35,fig.4; 1966 Fleming, N.Z.Dept.Sci.& Ind.Res.Bull. 173:61; 1967 Beu, Trans. R.Soc.N.Z.,Geol. 5(3):108.
1969. *Benthindsia incerta* (King),Beu, N.Z. J.Geol.& Geoph. 12(2-3):493, figs.8-10.

TYPE LOCALITY. Cliffs east of Lake Ferry, Palliser Bay, Upper Pliocene of New Zealand.

Type specimens. In N.Z. Geological Survey, Lower Hutt; length 30.0 mm, width 17.0 mm.

Beu (1969) re-assigned *Austrofusus incertus* to the genus *Benthindsia* (= *Nassaria*) and compared it with *B.miriamae* Dell,1967 (= *Nassaria spinigera* Hayashi & Habe,1965). Although superfically similar in sculpture to the Australian *Nassaria problematica* (Iredale), the shape of *incertus* is more like that of *Austrofusus* and the thickened, variced and denticulate outer lip and 1-2 parietal denticles and 1 basal denticle on the columella are *Nassaria* features not visible in either the incomplete holotype of *incertus* nor the specimens figured by Beu *(op.cit.)* or the specimen illustrated here (Figs. 37,38). The placement of *incertus* in *Nassaria(Microfusus)* is very tentative and requires confirmation.

Nassaria(Microfusus) cf. problematica (Iredale,1936) (Fig. 39)

1936. *Benthindsia problematica* Iredale, Rec.Auckland Inst.Mus. 19(5):318, pl.23,fig.7.
1981. *Nassaria(Microfusus)problematica* (Iredale), Cernohorsky, Monog.mar. Moll. No.2:31,pl.1,fig.6 (protoconch); pl.2,figs.1,2 (operculum); pl.3,fig.4 (radula); pl.26 (shell).

TYPE LOCALITY. Off Sydney, N.S.W., Australia, 201 m.

Type specimens. In Australian Museum, Sydney, No.C-60665; length 26.1 + mm, width 13.6 mm.

Mr B. Marshall, National Museum of N.Z., Wellington, kindly forwarded to me an incomplete specimen of a *Nassaria* species from Rangatira Knoll, N.W. of White I, 162-407 m, on loan. This particular specimen has the upper spire whorls and part of the aperture missing, but from the remaining features of shape and sculpture, the individual closely resembles the Australian species *N.(M.)problematica*. Further collection of better preserved material may confirm the existence of *N.(M.)problematica* in New Zealand waters.

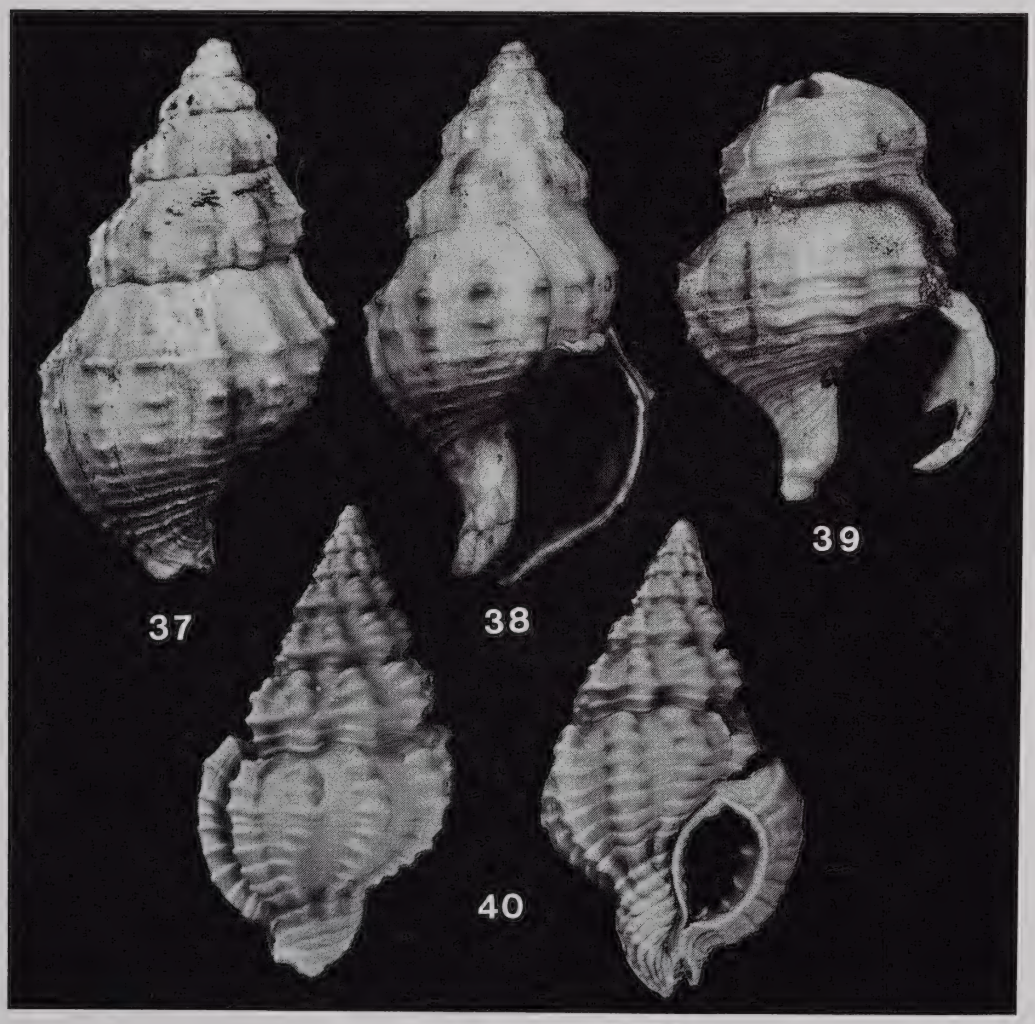
Genus **Trajana** Gardner, 1948

Trajana Gardner,1948, U.S.Geol.Surv.Prof.Pap.199-B:221. Type species by OD *T.pyta* Gardner,1948. U.Miocene of N.Carolina and Florida.

Subgenus **Nerva** E.H.Vokes, 1969

Trajana(Nerva)woodringi E.H. Vokes,1969 (Fig. 40)

1969. *Trajana(Nerva)woodringi* E.H.Vokes, Tulane Stud.Geol.Paleont.7(1-2): 77,pl.1,figs.2a,b; 1981 Cernohorsky, Monog.mar.Moll. No. 2:43.



Figs. 37-40. 37,38. *Nassaria(Microfusus)incerta* (King). Cliffs west of Whangaimoana, Palliser Bay, N.Z., NMNZ Wellington No.M-26580; 35.2 mm. 39. *N.(M.) cf. problematica* (Iredale). Rangatina Knoll, N.W. of White I, N.Z., 162-407 m, NMNZ Wellington No. M-74598; 28.8+ mm. 40. *Trajana (Neoteron)woodringi* E.H.Vokes. Holotype USNM No.646229; 14.0 mm (photo courtesy Dr E.H.Vokes).

TYPE LOCALITY. E. of Cativa, Province of Colon, Panama, Gatun formation, middle Miocene.

Type specimen. In the National Museum of Natural History, Washington, USNM No. 646229; length 14.0 mm, width 8.0 mm.

Through the courtesy of Dr E.H. Vokes, Tulane University, I was able to examine further specimens of *T.(N.)woodringi,* and the original placement by Vokes (1969) in *Trajana* is the correct one. The subgenus *Nerva* differs from *Trajana* primarily in the strongly denticulate outer lip and columella (Fig. 40).

Family NASSARIIDAE

Genus **Nassarius** Duméril, 1806

Nassarius Duméril,1806, Zool.Analyt. p.166. Type species by SM (Froriep, 1806) *Buccinum arcularia* Linnaeus,1758. Recent, Indo-Pacific.

Nassarius crebricostatus (Schepman,1911) (Figs. 41-45,48)

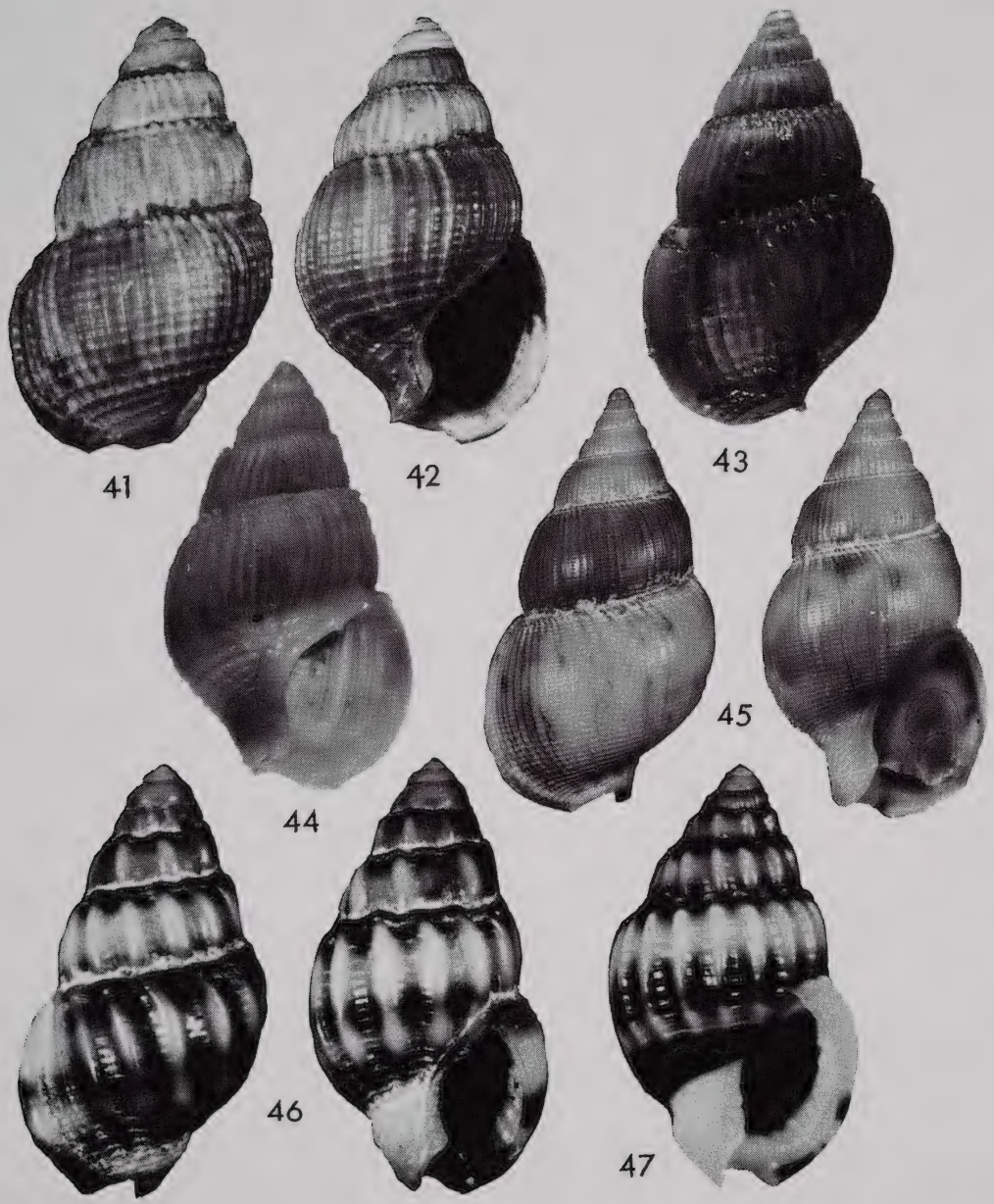
1911. *Nassa(Alectryon,Aciculina) crebricostata* Schepman, Siboga-Exped.49d: 318,pl.20, figs.3a,b.
1930. *Nassarius(Hima)beccarii* Bisacchi, Ann.Mus.Civ.Stor.Nat.Genova 55:61, textfigs. 7,8.

TYPE LOCALITY. Molucca Passage, Indonesia, 0°11'S & 127°25'E, 397 m *(crebricostatus);* Dilemni, Red Sea *(beccarii)*.

Type specimens. Syntypes of *N.crebricostatus* (Schepman) are in the Zoological Museum, University of Amsterdam (Figs. 41,42). The holotype of *N.beccarii* Bisacchi is in the Museo Civico Storia Natural, Genoa, length 11.0 mm, width 6.0 mm (Figs. 43,44).

The previously known distribution of *N.crebricostatus* was from the Red Sea to the Philippines and Northern Australia, from 124-472 m. Recently specimens have been obtained from Moruroa Atoll, Tuamotu Archipelago, in 350-400m , by the Museum National d'Histoire Naturelle, Paris (Fig. 45).

The species ranges in size up to 16.0 mm in length but most specimens encountered are only half this size. There are 4-5 mature, inflated, convex whorls and 3-3½ glassy, keeled embryonic whorls, axial sculpture is variable with axial ribs numbering from 25-35 in the syntypes of *N.crebricostatus* although some individuals may have as many as 50 ribs on the penultimate and 45 on the body whorl; some specimens have distinct axial ribs others weak and low ribs, and ribs may be distinct or obsolete on the body whorl. The spiral striae appear as short grooves between the ribs. The illustrated type specimens of *N.crebricostatus* and *N.beccarii* and the Moruroa specimen are not fully mature, and in mature specimens the outer lip has 7-15 denticles and the columella is either smooth or has up to 4 weak folds. The colour is off-white, fawn or pale yellow and the operculum is yellowish-brown with simple margins. The rachidians of the radula have 11 denticles, an accessory lateral plate is absent and lateral teeth are bicuspid and simple (Fig. 48).



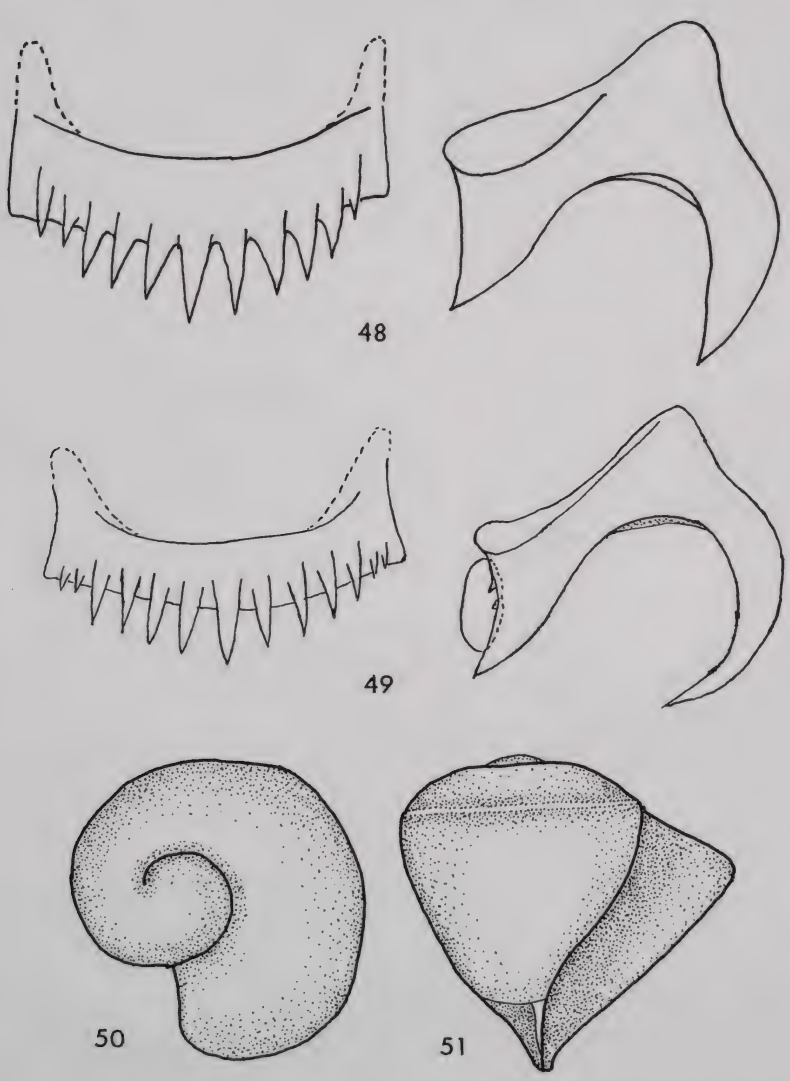
Figs. 41-47. 41-45. *Nassarius crebricostatus* (Schepman). 41,42. Syntype ZM Amsterdam; 6.7 and 7.7 mm respectively (immature). 43,44. Holotype of *N.beccarii* Bisacchi, MCSN Genoa; 11.0 mm (immature). 45. Specimen from Moruroa Atoll, Tuamotu Archipelago, 350-400 m; 15.6 mm. 46,47. *N.tabescens* Marrat. 46. Holotype MCM Liverpool; 7.0 mm. 47. Specimen from Mahina, Tahiti, Society Is; 7.4 mm.

Nassarius tabescens (Marrat,1880) (Figs. 46,47,49-51)

1880. *Nassa tabescens* Marrat, Var.shells gen.*Nassa*, pp.74,81.

TYPE LOCALITY. None.

Type specimens. The holotype of *N.tabescens* (Marrat) is in the Merseyside County Museum, Liverpool, length 7.0 mm, width 4.0 mm. There are 3½ whorls of the teleoconch and 3¼ keeled embryonic whorls, 10 axial ribs and 6 fine spiral grooves on the penultimate and 11 ribs and 10 grooves on the body whorl, 5 basal cords, 10 denticles on the outer lip and 4 on the columella. The shell is white with rusty-brown bands (Fig. 46).



Figs. 48-51. 48. *Nassarius crebricostatus* (Schepman). Half-row of radula. 49-51. *N.tabescens* (Marrat). 49. Half-row of radula. 50,51. Top and apertural view of embryo.

The species has been described from unknown locality and the only documented recent record is from Tahiti. (Fig. 47). Eight specimens have recently been received from Mahina, Baie de Matavai, Tahiti, 12 m (leg. J.Trondle), and two of these specimens were found to have apertures filled with embryos. After extraction of the animal, further embryos were found on top of the foot, and within the mantle lobe a small cluster of undeveloped eggs was also found. There were between 50-60 embryos in each shell and some may have already been liberated by the females. The size of the translucent embryos ranged between 0.18 mm to 0.25 mm in width in a shell 7.4 mm in length, and embryos were rather broad in relationship to their length and also had a well-developed spiral keel which bore traces of a brown colour (Figs. 50,51).

The radular ribbon is 2.3 mm in length in a shell 7.0 mm in length and contains 53 rows + 3 rows of nascentes of teeth; a small accessory lateral plate is present and the inward facing cusp of the lateral tooth has 1-2 small denticles or none at all (Fig. 49).

Ovoviviparity in Nassariidae has been reported in the West African *Nassarius muellleri* (v.Maltzan,1884) [Knudsen 1956], *N.elatus* (Gould,1845) and *N.cabrierensis ovoideus* (Locard,1886) [Adam & Glibért 1974], the Caribbean *N.albus* (Say,1826) [Kaicher 1972; Cather 1973a, 1973b] and the South African *Bullia nuttalli* Kilburn,1978 (Kilburn 1978). This is the first report of ovoviviparity in a tropical Indo-Pacific nassariine species.

It should be noted that two different types of development have been reported for the Caribbean *N.albus* (Say). Specimens from Bermuda and Campeche, Mexico, were found to be ovoviviparous (Kaicher 1972; Cather 1973a,b). Bandel (1976), however, reports spawns of *N.albus* from Santa Marta, Caribbean coast of Columbia, which were composed of egg-capsules containing 60-80 eggs which hatched after 6 days when free-swimming veliger-larvae were released. This radical difference in development may be due to a misidentification of the species by Bandel.

Family MITRIDAE

Genus **Mitra** Lamarck, 1798

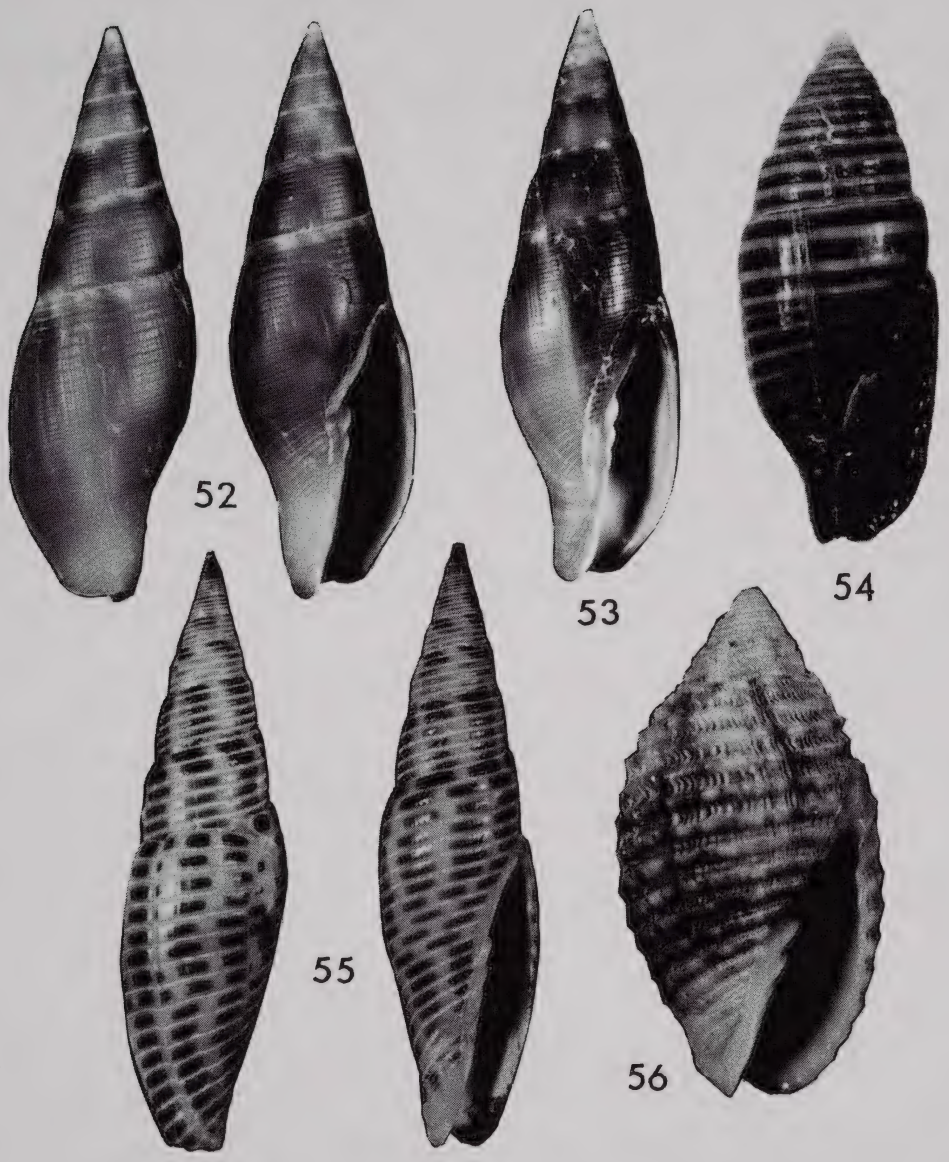
Mitra Lamarck,1798, Tabl.Encycl.Meth. pl.369. Type species by T *Voluta mitra* Linnaeus,1758 (Opinion 885 of ICZN). Recent, Indo-Pacific.

Mitra subflava (Kuroda & Habe,1971) (Figs. 52,53)

1971. *Vicimitra subflava* Kuroda & Habe, Sea shells Sagami Bay,p.189,pl.53, fig.2.
1976. *Mitra subflava* (Kuroda & Habe), Cernohorsky, Indo-Pacific Moll. 3(17):352, pl.308, fig.1.

TYPE LOCALITY. Sagami Bay, Japan.

The species has been imperfectly known since the date of description and has been considered endemic to Japan. Recent deep water dredging at Panlao, Bohol, Philippines (ex- V.Dan) has brought to light several specimens of the species (Figs. 52,53). *M.subflava* closely resembles the Austral-Neozelanic *M.carbonaria* Swainson,1822.



Figs. 52-56. 52,53. *Mitra subflava* (Kuroda & Habe). Panlao, Bohol, Philippines; 25.1 mm and 31.9 mm respectively. 54. *M.vexillum* Reeve. Glasis, Seychelles Is; 29.6 mm. 55. *Ziba rehderi* (Webb). Panlao, Bohol, Philippines; 25.6 mm. 56. *Mitra pudica* Pease. Mahina, Tahiti, Society Is; 14.7 mm.

Subgenus **Nebularia** Swainson, 1840

Nebularia Swainson,1840, Treat.Malac.pp.130,319. Type species by SD (Herrmannsen,1847) *Mitra contracta* Swainson,1820. Recent, Indo-Pacific.

Mitra(Nebularia)vexillum Reeve,1884 (Fig. 54)

1844. *Mitra vexillum* Reeve, Conch.Iconica 2:pl.23,figs.183a,b.
1976. *Mitra(Nebularia)vexillum* Reeve,Cernohorsky, Indo-Pacific Moll. 3(17):430, col.pl.257, figs.6,7; pl.377.

TYPE LOCALITY. Philippine Islands.

The previously known distributional range of the species was from the Philippines to the Ryukyu and Solomon Islands. The new record from Glasis, near the Tirant River, Mahe, Seychelles Islands, 8 m, under a coral dome (leg. T.R.Perrault) is a considerable westward range extension into the Indian Ocean (Fig. 54). In view of this new record, Shopland's (1902) record from "Aden" may prove to be correct after all.

Mitra(Nebularia)pudica Pease,1860 (Figs. 56,57)

1860. *Mitra pudica* Pease,Proc.Zool.Soc.Lond. pt.28:146 (publ.February-May, 1860).
1860. *Mitra nuxavellana* Dohrn, Proc.Zool.Soc.Lond. pt.28:368 (publ.August, 1860 - March,1861).
1872. *Mitra texturata* var. *lifouana* Crosse, J.Conchyl. 20:74; 1872 Crosse, J.Conchyl. 20:219, pl.13,fig.5.
1880. *Mitra subtexturata* Garrett, J.Conch. 3:26.
1972. *Pterygia pudica* (Pease), Cernohorsky, Marine shells Pacific 2:173, pl.52,fig.1; 1974 Quirk & Wolfe, Seashells of Hawaii p.24,fig.15; 1979 Kay, Hawaiian mar.shells p.307,fig.105F; 1980 Pechar,Prior & Parkinson, Mitre shells Pacific & Indian Ocean pl.26,figs.4,5.

TYPE LOCALITY. Hawaiian Is *(pudica* and *muxavellana);* Lifu, Loyalty Is *(lifouana);* Raiatea I, Society Is *(subtexturata).*

Distribution. Tropical Pacific.

Recent authors have placed the species in the genus *Pterygia* Röding, 1798, subfamily Cylindromitrinae, containing a group of species characterized by a *Voluta*-like radula containing only a single rachidian per row. The species *Mitra pudica* has a very minute radula of 1.9 mm length in a shell 14.7 mm in length; the ribbon contains 39 rows + 3 nascentes rows of teeth and each row has 3 mitrid-like teeth (Fig. 57). The species must be re-assigned to the genus *Mitra* Lamarck, subgenus *Nebularia* Swainson.

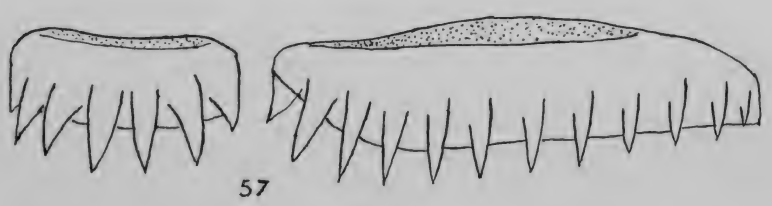


Fig. 57. *Mitra(Nebularia)pudica* Pease. Mahina, Tahiti. Half-row of radula.

Genus **Ziba** H. & A. Adams, 1853

Ziba H. & A. Adams,1853, Gen.Rec.Moll. 1:179. Type species by SD (Wenz, 1943) *Mitra carinata* Swainson,1824. Recent, West Africa.

Ziba rehderi (Webb,1958) (Fig. 55)

1958. *Mitra rehderi* Webb, Venus:Jap.J.Malac. 20/1):30, textfigs.1,2.
1978. *Ziba cf. rehderi* (Webb), Cernohorsky, Rec.Auckland Inst.Mus. 15:60, figs.11,12.
1979. *Mitra rehderi* Webb var., Kosuge, Bull.Inst.Malac.Tokyo 1(2):27,pl.6, fig.26.
1982. *Ziba rehderi* (Webb),Cernohorsky, Bull.Mus.Nat.Hist.Nat. (4).3(4):991.pl.1,fig.4.

TYPE LOCALITY. Tosa, Japan, 90-100 fathoms (165-183 m).

Since the original description of *Ziba rehderi* from Japan, the species has been recorded from the Kermadec Islands, 512-585 m (Cernohorsky 1978), off Midway I, 82-265 m (Kosuge 1979) and the Mozambique Channel, 250-390 m (Cernohorsky 1982). This new record from deep water off Panlao, Bohol, Philippines (ex- V.Dan), confirms the species wide distribution (Fig. 55).

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TWO NEW SPECIES OF TRICHOPTERA FROM THE MURCHISON MOUNTAINS, SOUTH ISLAND, NEW ZEALAND

K.A.J. WISE

AUCKLAND INSTITUTE AND MUSEUM

Abstract. Two unique males are described as new species in the genera *Psilochorema* and *Edpercivalia* (Family Rhyacophilidae).

As the Murchison Mountains are isolated on the west side of Lake Te Anau in the south-west of the South Island, it is considered worthwhile to record two new species even though each is represented only by a unique male specimen.

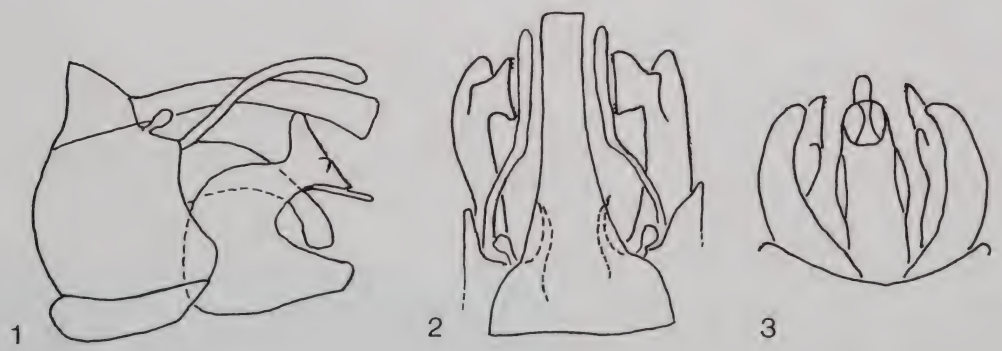
Family RHYACOPHILIDAE
Genus **Psilochorema** McLachlan, 1866

Psilochorema embersoni Wise, sp.n. (Figs. 1-3)

Species typical of genus in wing pattern, wing venation and, in male, a pair of ventral elongate appendages on Abdomen VI and posterior median ventral process on Abdomen VII.

Genitalia, ♂ (Figs. 1-3). Dorsal process (Segment X) membranous, elongate. Above superior appendages an internal curved spine together with an external rounded process on each side; superior appendages long, bent near middle. Inferior appendages short, stout, tapering to apex ventrally in lateral view, with apical inner teeth; dorsal arm wide, expanded apically; apical expansion bent inward with outer angle bearing a central tubercle; points of expansion sub-equal in length, bearing internal teeth. Aedeagus with mid-length lateral expansions and a dark apical dorsal flap.

Measurements. Length of forewing 11.5mm.



Figs. 1-3. *Psilochorema embersoni* Wise, sp.n. Male genitalia. 1. Lateral. 2. Dorsal. 3. Ventral.

Specimen examined. SOUTH I. Holotype ♂ . Murchison Mts (FD), E. McKenzie Burn, 1110m, 8.XII.1980, R.M. Emberson, C.A. Muir. Lodged in Auckland Museum, Auckland.

The genitalia of this male specimen is closest to that of *Psilochorema nemorale* McFarlane, 1951, from the Southern Alps to the north. The inferior appendages appear in lateral view to be intermediate between those of that species and such species as *Ps. macroharpax* McFarlane, 1951, *Ps. bidens* McFarlane, 1951, and *Ps. donaldsoni* McFarlane, 1960. In the last three species the ventral portion of the inferior appendage is large and the dorsal arm is small or thin, in *Ps. embersoni* the ventral portion is smaller and the dorsal arm larger, while in *Ps. nemorale* the ventral portion is very reduced and the large dorsal arm is the major part of the appendage.

The species is named for Dr R.M. Emberson who collected some aquatic insects in the Murchison Mts and made them available to the author.

Genus **Edpercivalia** McFarlane, 1964

Edpercivalia harrisoni Wise, sp.n. (Figs. 4-7)

Species typical of genus in wing pattern, wing venation and, in male, a mid-ventral posterior spine on Abdomen VII and ventral extensions of posterior margin on Abdomen VIII, IX.

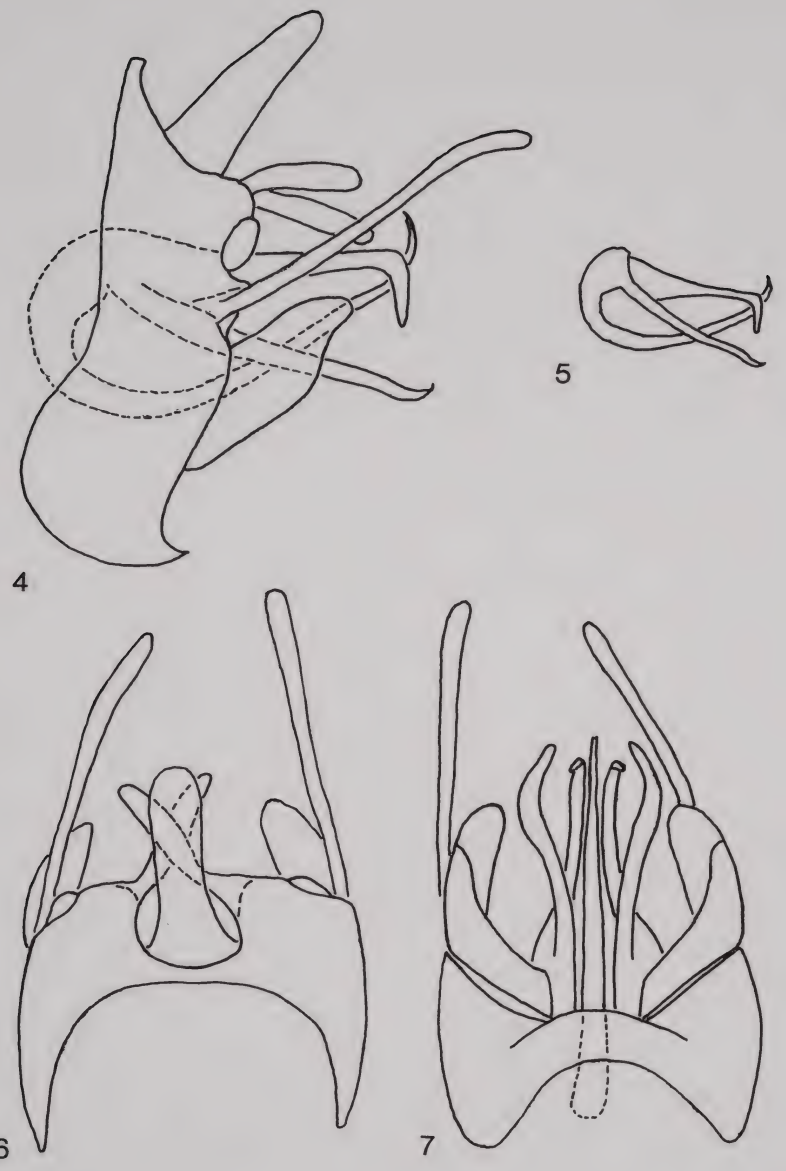
Genitalia, ♂ (Figs. 4-7). Dorsal process (Segment X) membranous. Segment IX reduced to a thin band dorsally; paraproctal processes large, conspicuous, with short setae dorsally, crossed-over in present specimen; below each process a lateral setose protuberance. Superior appendages elongate. Inferior appendages short, elongate in lateral view with apex rounded dorsally and concave below. Aedeagus (Fig.5) curved dorsally with paired appendages, the dorsal pair strongly down-curved before apices, the ventral pair slightly up-curved at tip, all dark-brown.

Measurements. Length of forewing 16mm.

Specimen examined. SOUTH I. Holotype ♂. Murchison Mts (FD), Plateau Ck, 990m, on rock at night, 2.XII.1980, R.M. Emberson, C.A. Muir. Lodged in Auckland Museum, Auckland.

Species of this genus can be separated by the appearance of the inferior appendage in lateral view. *Edpercivalia spaini* McFarlane, 1973 is perhaps the closest with a short, square inferior appendage, then *E. harrisoni* with a longer appendage, and other species such as *E. banksiensis* (McFarlane, 1939), *E. maxima* (McFarlane, 1939), *E. shandi* (McFarlane, 1951) and *E. thomasoni* (McFarlane, 1960) with the inferior appendage of various forms.

The species is named for Professor R.A. Harrison, previously head of the Entomology Department, Lincoln College, as a tribute to his entomological research and teaching.



Figs. 4-7. *Edpercivalia harrisoni* Wise, sp.n. Male genitalia. 4. Lateral. 5. Aedeagus. 6. Dorsal. 7. Ventral.

Acknowledgements. The author is grateful to Dr R.M. Emberson, Entomology Department, Lincoln College, Canterbury, N.Z., for making specimens available and giving permission for the holotypes to be lodged in the Auckland Museum.

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